FINAL REPORT

CONTRACT DSS 23SQ.23440-8-9127

Title Beneficiation of four metallurgical coals to three specific ash levels.

CONTRACT SERIAL NO: OSQ79-00077

CONTRACTOR: Great West Steel Industries Limited

REQUISITION NO: 23440-8-9127

FINAL REPORT

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Title Beneficiation of four metallurgical coals to three specified ash levels.

Method

Classical washability curves were determined for ¾×28 and 28×65 mesh size samples of each of the four coals. A laboratory flotation test was carried out on each coal in order to judge the correct conditions for the pilot-scale washing. A description of the pilot plant and its operation is given in Part 1.

Results

Classical washability curves, froth flotation tests and all pertinent data related to pilot plant washing is given in the following order

Part 2. Denison coal

Part 3. B.P. coal

Part 4. Fording coal

Part 5. Cardinal River coal

Conclusions

The following ash contents and yields were achieved

	HIGH ASH %	YIELD %	MEDIUM ASH %	YIELD %	LOW ASH %	YIELD %
DENISON	8.5	87.3	7.3	73.4	5.8	69.7
B.P.	6.8	95.8	5.1	88.6	3.2	82.2
FORDING	9.3	67.7	6.6	62.0	5.0	54.9
CARDINAL RIVER	10.6	85.6	8.4	69.4	6.5	51.4

113pp

MICROMEDIA

PART I
PILOT PLANT OPERATION

PILOT PLANT WASHING

Figure 1 is the flowsheet of the Birtley Coal & Minerals Testing pilot plant. Raw coal is dumped by a front end loader into a hopper at ground level, which has a heavy 2" square screen installed to ensure that the bucket elevator receiving the feed does not handle oversize material. The 2" oversize coal is crushed manually to pass the 2" screen, but "rock" is collected in barrels and reported as shale of the heavy media circuit. The bucket elevator discharges the minus 2" feed at a rate of 5 to 7 metric tons per hour into a rotary 3/4" screen of the third deck. The 3/4" oversize falls via a chute into a 5" x 8" jaw crusher where it is crushed to minus 3/4" and is recycled through the feed system. The 3/4" x 0 screen underflow is washed with water onto a 28 mesh sieve bend and slot screen for desliming.

The 3/4" x 28 mesh coal is the feed to the 14" DSM Heavy Media cone on the seond deck. The slurry of coal and correct medium is pumped to the cyclone from the mixing tube at a pressure of 9 to 10 psi. The overflow and underflow products are discharged onto a common, but split 28 mesh slot screen preceded by a 28 mesh sieve bend where the magnetite is washed off into the correct and dilute medium tanks directly below. Additional clean spray water and baffles across the clean coal stream ensure that a minimum of magnetite is retained on the clean coal product. The clean coal and shale are collected in barrels by means of individual chutes for weighing.

The dilute medium is pumped to a thickening cone on the third deck from where it is fed to a 30" magnetic separator. The recovered magnetite is sluiced back to the correct medium tank. The specific gravity of the medium is monitored manually, using a density meter, and adjusted for loss by adding cyclone grade magnetite directly to the correct medium tank.

The 28 mesh x 0 coal collected in the slimes tank ground level, is pumped to the thickening cone on the third deck. From this point it can be fed directly to the froth circuit, or as is usual, to the two-stage water-only cyclone system.

Coal to the 6" DSM water-only primary cyclone is pumped at a pulp density of 10% to 20% from the cyclone feed rank at a pressure of 20 psi, and a flow rate of 85 imperial gallons per minute. A mechancially adjustable vortex finder facilitates settings for a desired ash content. The primary cyclone underflow with make-up water is fed to a similarily adjustable secondary 4" unit. The overflow is directed back to the primary cyclone feed tank with the underflow being the waste product.

The waste product is routed to the static thickener while the primary underflow is fed by gravity to a rapped 0.25 mm sieve bend. The seive bend is the water-only cyclone product at approximately 65 mesh oversize, and directed to the Eimco disc filter for dewatering.

The sieve bend underflow passes by gravity to the thickening cyclone feed tank, from where it is pumped to the 20° - 8" cyclone. This thickening cone serves a dual purpose: 1) it removes undesireable -325 mesh slimes from the flotation feed, 2) it provides a feed of proper density (15% - 25% solids) to the froth cells. The overflow with the -325 mesh slimes flows to the static thickener.

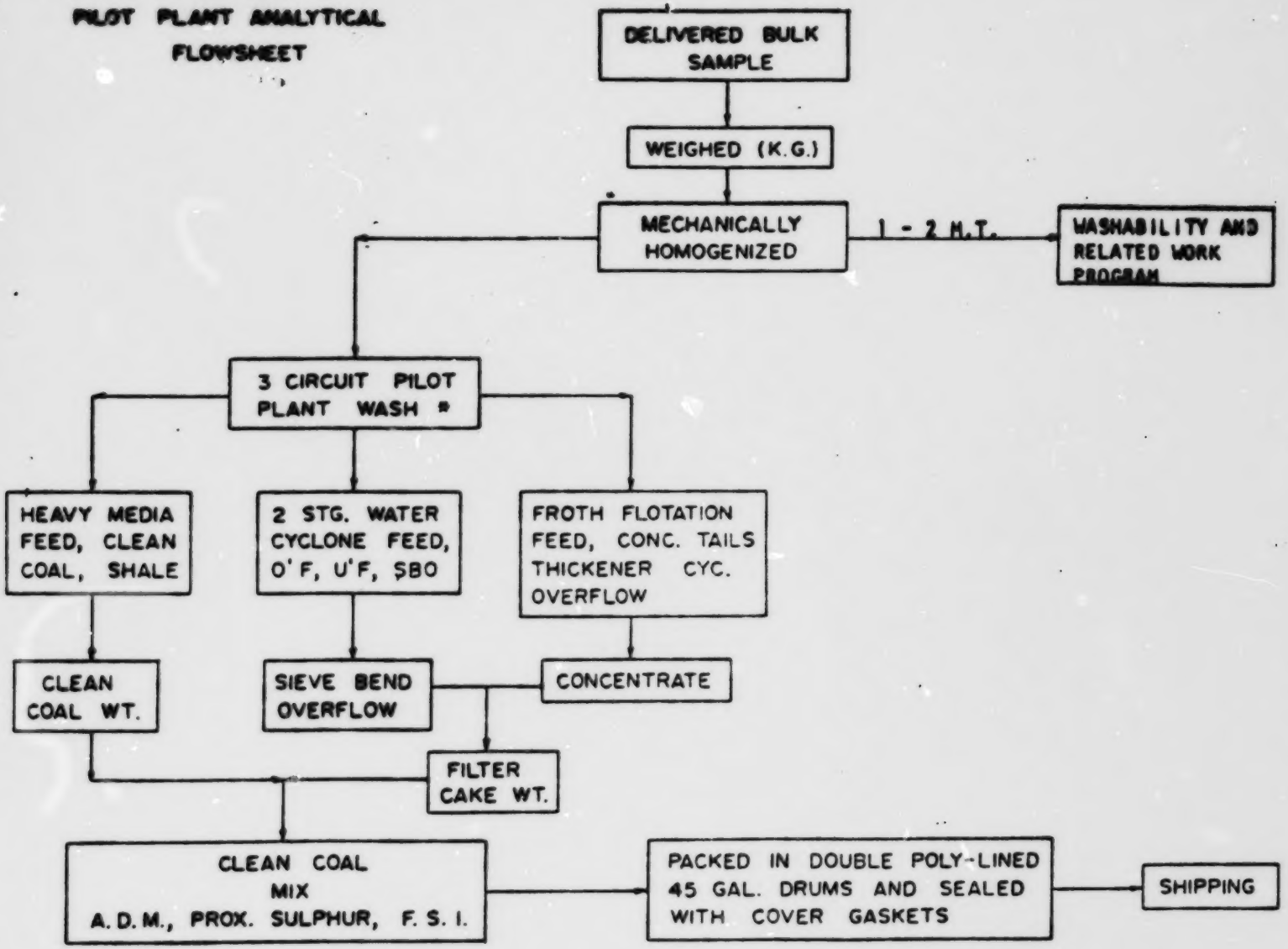
The flotation circuit consists of two (2) Birtley-Humboldt Multi-Wobble Cells in series. Since these cells were installed on September 12th, 1976, there appears to be a marked improvement in tailings ash contents, indicating excellent recovery of froth product. A rotary reagent feeder introduces 4:1 Kerosene:Methylisobutylcarbinol into the circuit at the feed entry point for better conditioning.

The tailings join the water-only cyclone underflow and thickener cone overflow to form the thickener tails. The froth enters the Eimco disc filter and is dewatered along with the sieve bend overflow to form the filter cake or fines product. This and the heavy media clean coal are combined to form the clean coal product or clean mix.

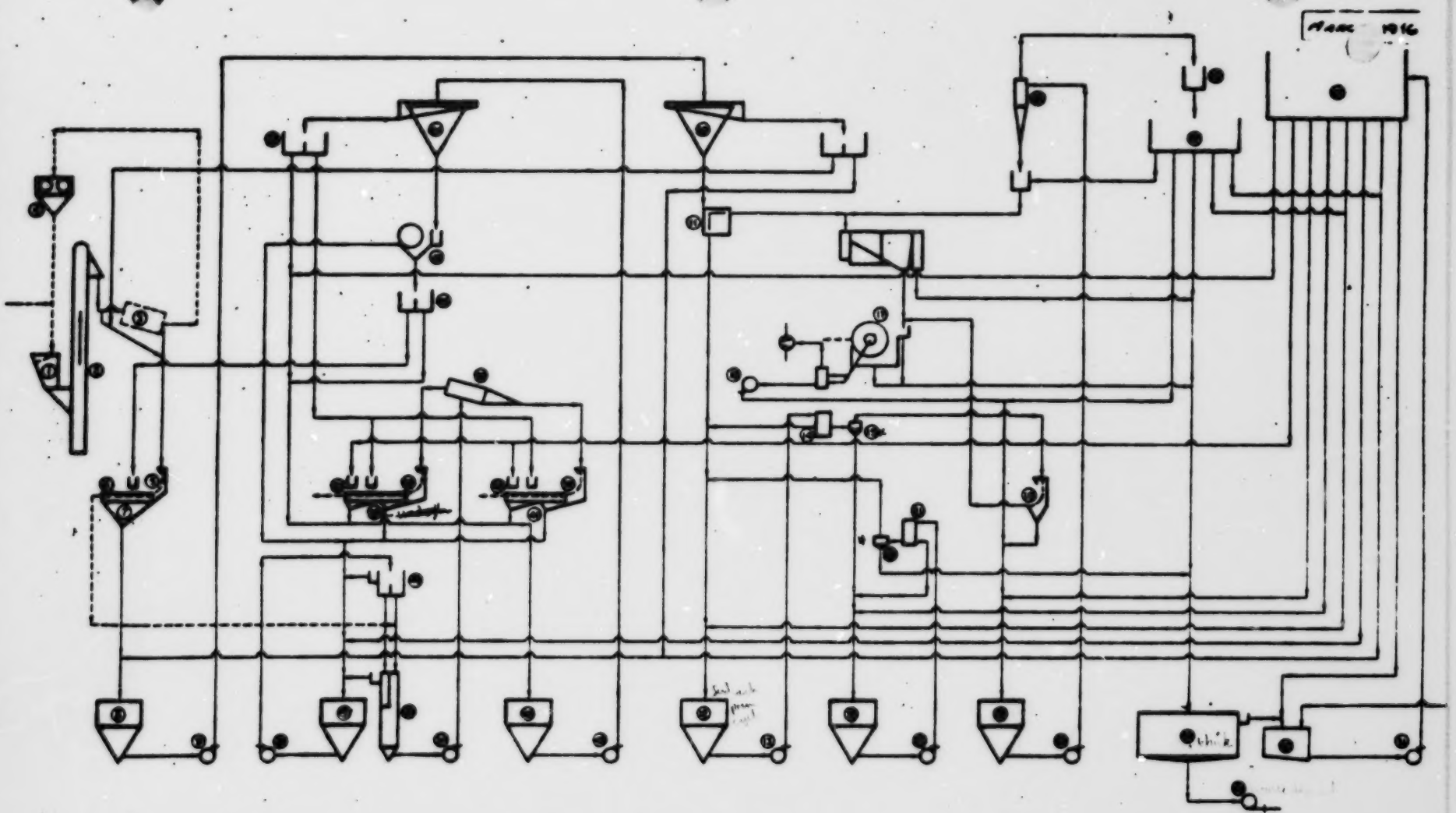
Each circuit is sampled for feed, product and waste in addition to the 0.25 mm sieve bend overflow and underflow, filter cake, thickening cyclone overflow and underflow and analysed for ash content. The primary water-only cyclone overflow product is screened at 65 mesh as the plus 65 mesh figure is used to calculate the yield of the water-only cyclone circuit.

The heavy media clean coal is "drained" of extraneous moisture before being combined and homogenized with the partially dried filter cake. This partial drying is accomplished by spreading the fines product on a pad, heated electrically at 20°C, and reducing the moisture content from 22 - 28% to less than 12%.

TYPICAL PILOT PLANT ANALYTICAL FLOWSHEET

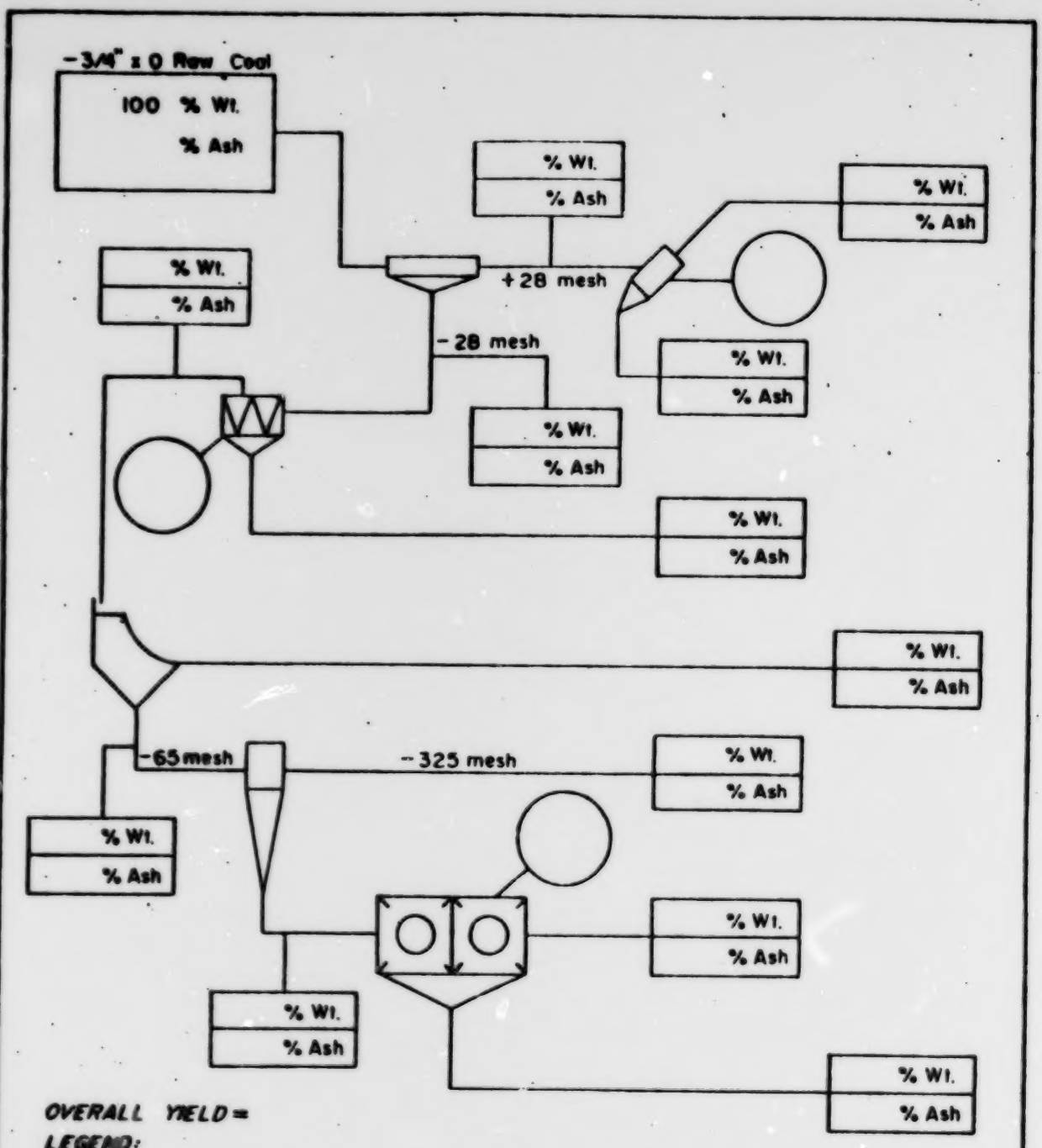

DELIVERED BULK SAMPLE
WEIGHED (K.G.)
MECHANICALLY HOMOGENIZED
1 - 2 M.T.
WASHABILITY AND RELATED WORK PROGRAM
3 CIRCUIT PILOT PLANT WASH *
HEAVY MEDIA FEED, CLEAN COAL, SHALE
2 STG. WATER CYCLONE FEED, O'F, U'F, SBO
FROTH FLOTATION FEED, CONC. TAILS THICKENER CYC. OVERFLOW
CLEAN COAL WT.
SIEVE BEND OVERFLOW
CONCENTRATE
FILTER CAKE WT.
CLEAN COAL MIX
A.D.M., PROX. SULPHUR, F.S.I.
PACKED IN DOUBLE POLY-LINED 45 GAL. DRUMS AND SEALED WITH COVER GASKETS
SHIPPING

* ALL PLANT SAMPLES ANALYSED FOR ASH AND F.S.I.



TEST PLANT FLOWSHEET

COAL SCIENCE & MINERALS TESTING



BIRTLEY ENGINEERING (CANADA) LTD.

Title	Date
TYPICAL PLANT BALANCE SHEET	
	Drawn

BIRTLEY COAL & MINERALS TESTING

SPECIAL PROCEDURES FOR HANDLING OF BULK SAMPLES

HEAD RAW PREPARATION

The order of preference for delivery bulk samples is: 1) bulk truck loads. 2) poly-lined jute bags or re-enforced plastic bags. 3) barrels. The coal is dumped onto a steel mixing plate (32' x 60') and subjected to a preliminary mixing by means of a small front end loader and placed in a conical heap in the centre of the plate. (The bucket capacity is about 1 1/2 drums of coal).

Four (4) sampling points (quandrants) are selected along the perimeter of this central pile identified for clarity as Sites #1, #2, #3, #4, (see attached sketch) from which is withdrawn successive bucket loads of coal and placed in "quarter" conical piles relative to the sampling sites. However, to minimize the possibility of bias, on the second sampling pass, coal withdrawn from Site #1 is placed in pile #2, coal withdrawn from Site #2 is placed in pile #3 and so on until the central pile has been transferred into the 4 quartered piles.

Now the coal from the quartered piles is returned to the central location by taking bucket loads successively from piles A, B, C and D to reform the central conical heap. Four (4) sampling sites are relocated and the whole procedure is repeated three (3) more times after which a head raw sample is extracted, by taking small increments from each of the "quartered" piles of such quantity that four (4) increments will fill two (2) - 45 gallon drums using a portable loading hopper. This hopper is designed in such a way that two (2) barrels are filled simultaneously by means of a splite chute. The quantity of sample extracted is dependent on the top size of the coal and must conform to ASTM specifications for sampling of coal.

CLEAN COAL PREPARATION (Clean Mix)

After a preliminary moisture reduction of the heavy media clean coal and the fines filter cake to the desired levels, the products are homogenized as follows:-

The heavy media clean coal is spread in a thin layer on the meticulously clean mixing plate. The filter cake is "seeded" over the surface of the coarse coal by means of the front end loader. This total mass is subjected to a preliminary mixing routine and a central conical heap formed.

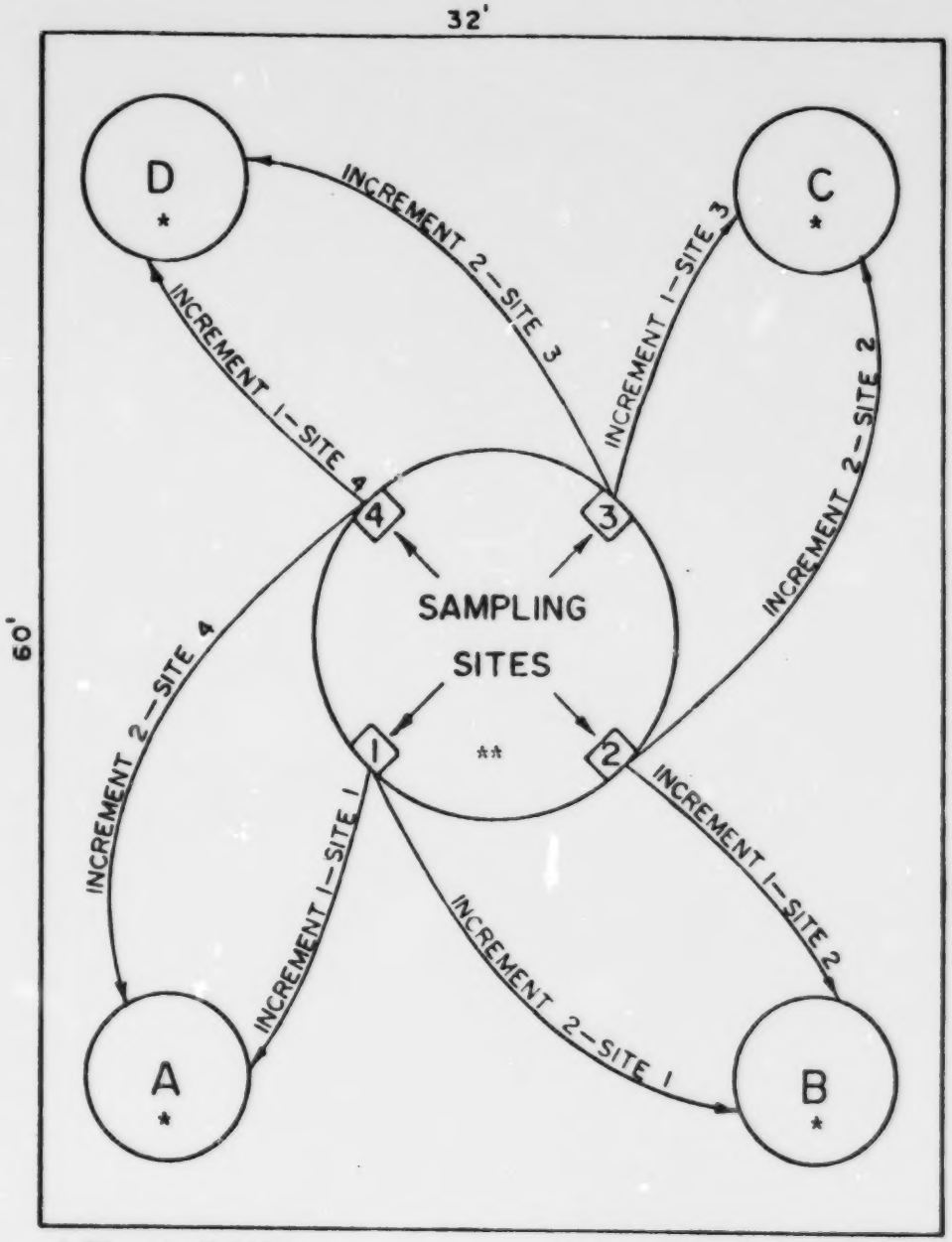
From this point on the procedures outlined for homogenizing the raw coal are strictly followed.

From the final four (4) quarters, double poly lined barrels are filled by exactly the same procedure as outlined for the raw coal sample extraction. The coal is tamped into the barrels so that each barrel contains about 180 kg including moisture.

During the barrel filling procedure, a minimum of 60 increments are taken from the bucket load quantities with a small square mouth shovel. Each increment is of such quantity that a minimum of 100 kg of coal are retained for analytical purposes.

Finally the plastic liners are tied off and an identifying tag affixed inside the drum. The lid, with a gasket, is firmly attached to seal the barrel and the barrel is stencilled as to contents and destination.

SCHEMATIC OF RAW AND CLEAN COAL HOMOGENIZATION



* "Quarter" Piles

** Central Pile

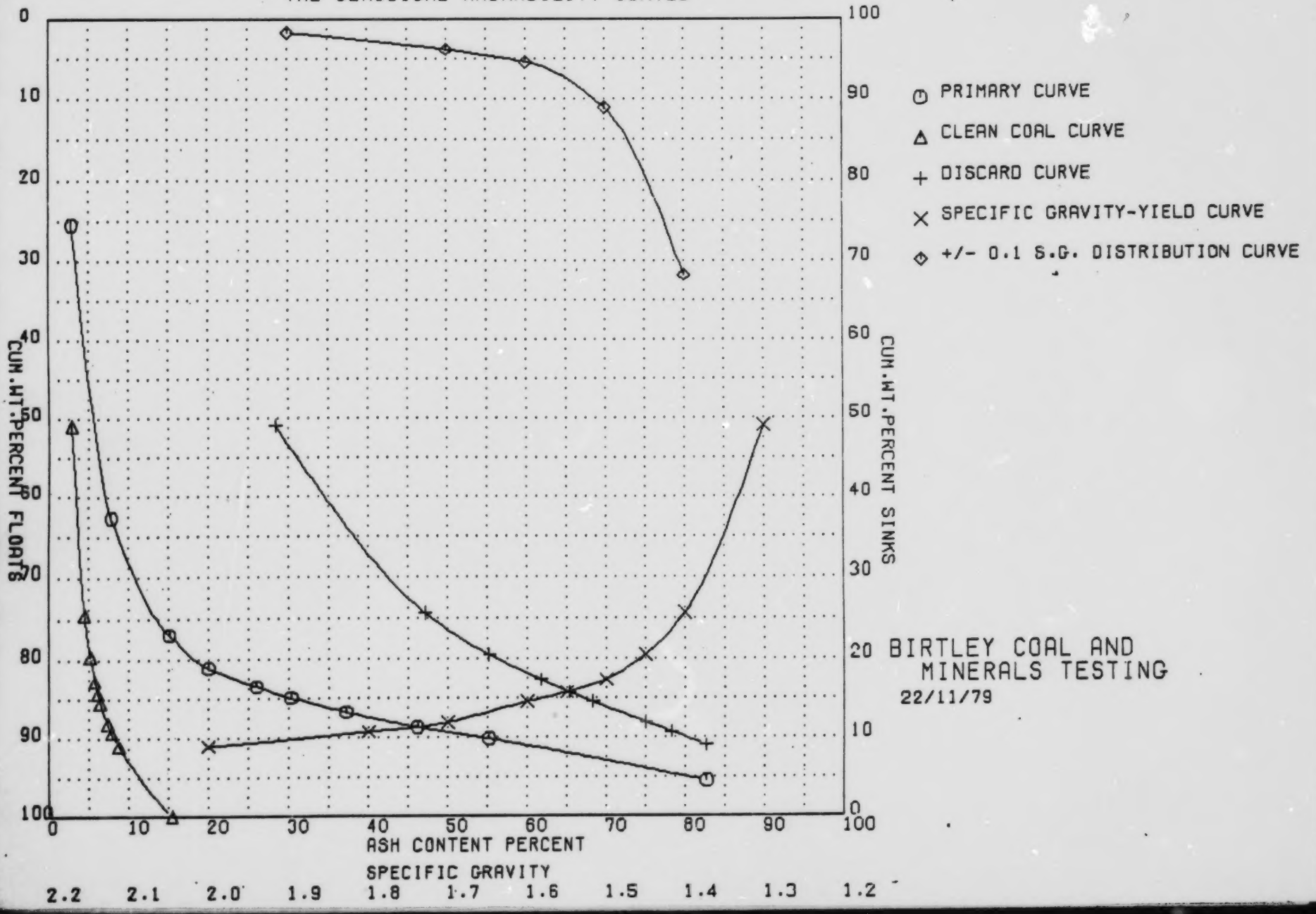
Continue moving increments until all of the central pile is transferred to the "Quarter" piles A,B,C, and D, i.e. increment 3, site 1 to C, increment 3, site 2 to D, increment 3, site 3 to A, increment 3, site 4 to B etc.

PART 2

DENISON COAL

BS3281SQ 23440-8-9127 DENISON 79-1-1 (X)3/4X28(WT.(=70.9) LAB. NO.: 3281

THE CLASSICAL WASHABILITY CURVES


CUM.WT.PERCENT FLOATS
CUM.WT.PERCENT SINKS
0 10 20 30 40 50 60 70 80 90 100
ASH CONTENT PERCENT
SPECIFIC GRAVITY
2.2 2.1 2.0 1.9 1.8 1.7 1.6 1.5 1.4 1.3 1.2
PRIMARY CURVE
CLEAN COAL CURVE
DISCARD CURVE
SPECIFIC GRAVITY-YIELD CURVE
+/- 0.1 S.G. DISTRIBUTION CURVE

BIRTLEY COAL AND MINERALS TESTING

22/11/79

DSS 23SQ 23440-8-9127 DENISON 79-1-1 (X)3/4X28(WT.(=70.9) LAB 3281

--DIRECT--				--CUM FLOATS--				--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	ASH WT> TT	CUM ASH	WT>	ASH>	ASH>	SINK WT>	ASH>	S.G.	WT
1	2	3	4	5	6	7	8	9	10	11	12
1.30	50.90	2.90	1.48	1.48	50.90	2.90	13.95	49.10	28.41	1.30	0.00
1.40	23.50	7.90	1.86	3.33	74.40	4.48	12.09	25.60	47.24	1.40	31.80
1.45	5.10	15.10	.77	4.10	79.50	5.16	11.32	20.50	55.23	1.50	11.10
1.50	3.20	20.00	.64	4.74	82.70	5.73	10.68	17.30	61.75	1.60	5.40
1.55	1.60	26.00	.42	5.16	84.30	6.12	10.27	15.70	65.39	1.70	3.80
1.60	1.20	30.30	.36	5.52	85.50	6.46	9.90	14.50	68.30	1.80	0.00
1.70	2.60	37.20	.97	6.49	88.10	7.37	8.94	11.90	75.09	1.90	1.70
1.80	1.20	46.20	.55	7.04	89.30	7.89	8.38	10.70	78.33	2.00	0.00
2.00	1.70	55.20	.94	7.98	91.00	8.77	7.44	9.00	82.70	2.10	0.00
9.99	9.00	82.70	7.44	15.43	100.00	15.43	0.00	.00	0.00	2.20	0.00

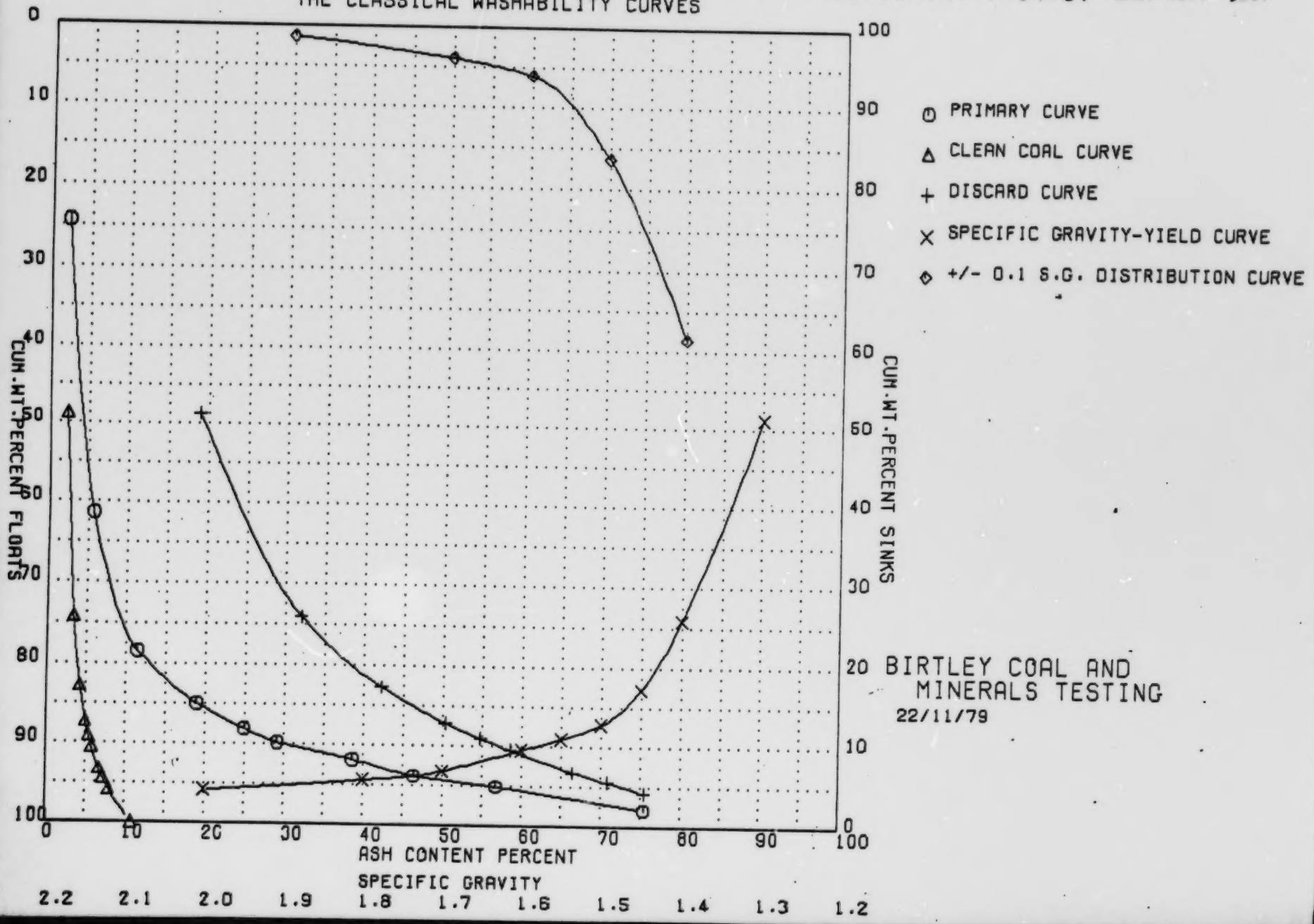
BIRTLEY COAL AND MINERALS TESTING
22/11/79

.6	14.9	.6	9.8	5.7	9.8	2.0	9.8	4.0	13.6		
1.6	7.5	.9	5.1	9.4	5.1	4.0	5.1	6.0	17.8		
3.0	4.6	1.0	4.1	11.0	4.1	5.0	4.1	8.0	18.9		
4.0	3.8	1.1	3.5	12.3	3.5	6.0	3.5	10.0	19.2		
5.2	3.3	1.2	3.1	13.1	3.1	7.0	3.1	14.0	19.7		
6.1	3.0	1.3	2.9	13.7	2.9	8.0	2.9	0.0	0.0		
7.4	2.6	1.5	2.4	15.0	2.4	10.0	2.4	0.0	0.0		
9.2	2.3	1.6	2.1	15.7	2.1	12.0	2.1	0.0	0.0		
11.0	2.0	1.8	1.8	16.5	1.8	16.0	1.8	0.0	0.0		
16.5	.9	3.1	.0	0.0	.0	175.8	.0	0.0	0.0		

PASS 1 10159
PASS 2 10 25
PASS 3 9108
PASS 4 9140
PASS 5 5100

BSS283SQ 23440-8-9127 DENISON 79-1-1 (B)28X65M(WT.(=14.8) LAB. NO.: 3281

THE CLASSICAL WASHABILITY CURVES


CUM.WT.PERCENT FLOATS
CUM.WT.PERCENT SINKS
ASH CONTENT PERCENT
SPECIFIC GRAVITY
0 10 20 30 40 50 60 70 80 90 100
2.2 2.1 2.0 1.9 1.8 1.7 1.6 1.5 1.4 1.3 1.2
PRIMARY CURVE
CLEAN COAL CURVE
DISCARD CURVE
SPECIFIC GRAVITY-YIELD CURVE
+/- 0.1 S.G. DISTRIBUTION CURVE

BIRTLEY COAL AND MINERALS TESTING

22/11/79

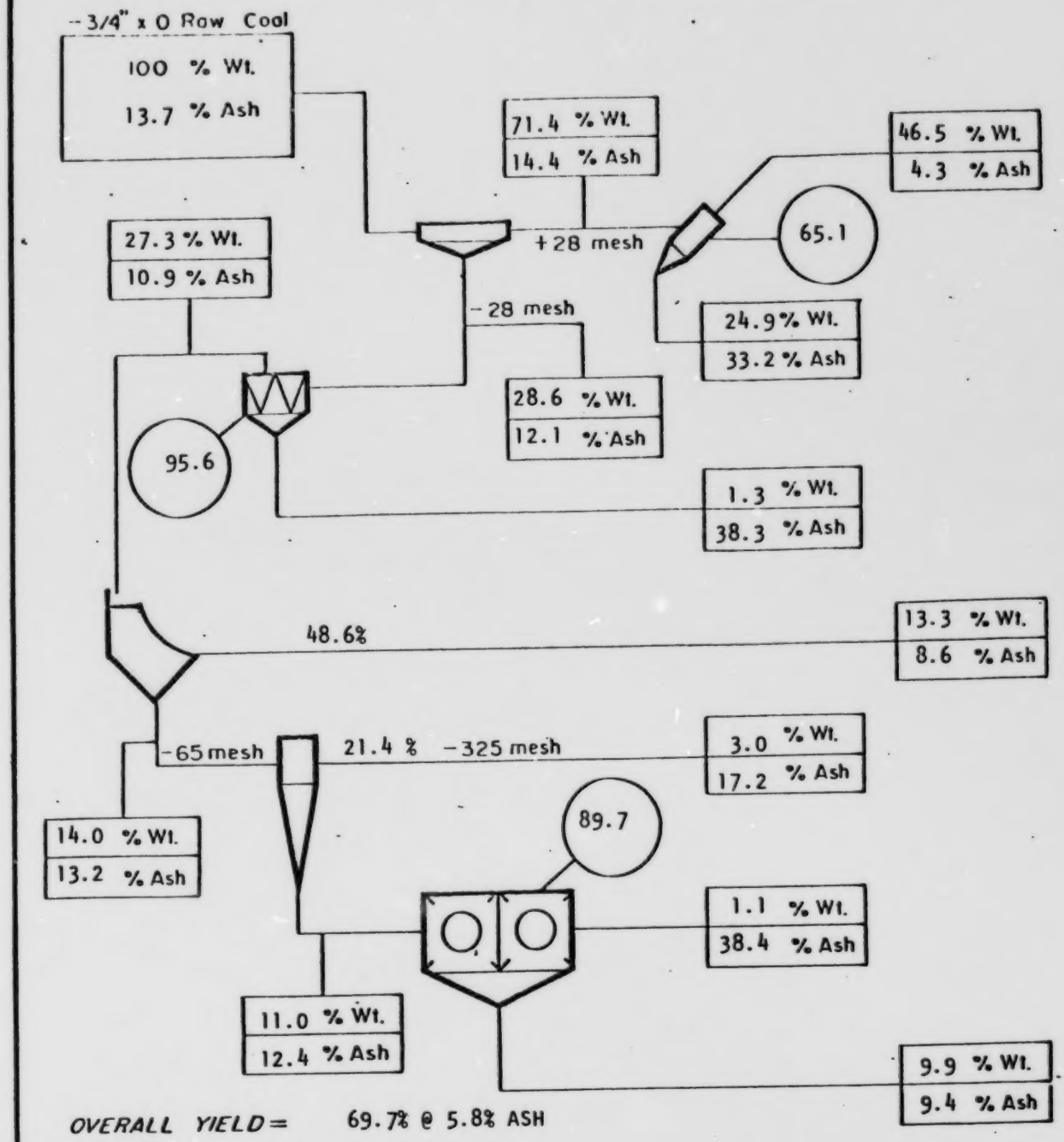
DSS 2350 23440-8-9127 DENISON 79-1-1 (B)28X65M(WT.(=14.8) LAB 3281

--DIRECT--				--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	ASH	WT> CUM TT	ASHTT	WT>	ASH>	ASH>	SINK WT>	ASH>	S.G.	WT
1		2	3	4		5	6	7	8	9	10	11	12
1.30	48.70		2.20	1.07	1.07	48.70	2.20	9.74	51.30	18.99	1.30	0.00
1.40	25.40		5.70	1.45	2.52	74.10	3.40	8.30	25.90	32.03	1.40	38.50
1.45	8.60		11.50	.99	3.51	82.70	4.24	7.31	17.30	42.24	1.50	16.40
1.50	4.50		19.00	.86	4.36	87.20	5.00	6.45	12.80	50.40	1.60	6.00
1.55	1.90		25.00	.48	4.84	89.10	5.43	5.98	10.90	54.83	1.70	3.90
1.60	1.40		29.20	.41	5.25	90.50	5.80	5.57	9.50	58.61	1.80	0.00
1.70	2.70		38.70	1.04	6.29	93.20	6.75	4.52	6.80	66.51	1.90	1.40
1.80	1.20		46.40	.56	6.85	94.40	7.25	3.97	5.60	70.82	2.00	0.00
2.00	1.40		56.80	.80	7.64	95.80	7.98	3.17	4.20	75.50	2.10	0.00
9.99	4.20		75.50	3.17	10.81	100.00	10.81	0.00	.00	0.00	2.20	0.00

BIRTLEY COAL AND MINERALS TESTING
22/11/79

.4	15.1	.4	10.3	3.8	10.3	2.0	10.3	4.0	12.3
1.1	7.7	.7	5.2	6.4	5.2	4.0	5.2	6.0	16.7
2.3	4.3	.8	3.5	8.4	3.5	5.0	3.5	8.0	18.8
3.8	3.0	1.0	2.6	10.1	2.6	6.0	2.6	10.0	19.2
5.0	2.4	1.1	2.2	11.0	2.2	7.0	2.2	14.0	19.7
5.8	2.0	1.2	1.9	11.7	1.9	8.0	1.9	0.0	0.0
7.7	1.6	1.4	1.4	13.3	1.4	10.0	1.4	0.0	0.0
9.3	1.2	1.5	1.1	14.2	1.1	12.0	1.1	0.0	0.0
11.4	1.0	1.6	.8	15.1	.8	16.0	.8	0.0	0.0
15.1	.4	2.2	.0	0.0	.0	175.8	.0	0.0	0.0

PASS 1 10146
PASS 2 10 17
PASS 3 9113
PASS 4 9140
PASS 5 5100



OVERALL YIELD = 69.7% @ 5.8% ASH

LEGEND:

○ *CIRCUIT YIELD %*

Wt.	*WEIGHT %*
Ash	*ASH CONTENT (AIR DRIED)*

BIRTLEY COAL & MINERALS TESTING

Title	DSS-23 SQ.23440-8-9127 BULK SAMPLE - BELCOURT 79-1-1 LAB. NO. 4179 LOW ASH COAL PLANT BALANCE FLOW SHEET
Date	November 1979
Drawn	

BIRTLEY COAL & MINERALS TESTING

DSS-23 SQ.23440-8-9127

BULK WASHING DATA*

LOW ASH COAL

ADIT BELCOURT 79-1-1 SEAM _____ LAB. NO. 4179

DELIVERY DATE _____ DATE OF WASH November 2, 1979

Raw Coal Analysis: ADM 3.5 ASH% 13.7 F.S.I. 7

Delivered Bulk Weight _____ Metric Tons

Washed Weight 3.099 Metric Tons

* All weight and analyses are on Air Dried Basis unless otherwise indicated.

Birtley Coal
& Minerals Testing

BULK WASHING DATA

HEAVY MEDIUM CIRCUIT

ADIT/SEAM NO. BELCOURT 79-1-1 LAB. NO. 4179

1. S.G. of Separation 1.40
2. Feed Ash Content 14.4 % F.S.I. 7
3. Clean Coal Estimated Weight 1.436 M.T.
4. Clean Coal Analysis - Ash 4.3 %F.S.I. 8 1/2
5. Reject Estimated Weight 0.777 M.T.
6. Reject Analysis - Ash 33.2 %F.S.I. 1 1/2
7. Estimated 3/4" x 28M in Circuit 2.213 M.T. 71.4 WT.%
8. Yield Clean Coal (Weighed) : 64.9 %
9. Yield Clean Coal (Calculated Ash Balance) - 65.1 %

Birtley Coal & Minerals Testing

BULK WASHING DATA

WATER-ONLY CYCLONE CIRCUIT

ADIT/SEAM BELCOURT 79-1-1 LAB. NO. 4179

1. Vortex Finder Clearance (VCF) #2 = 5.08 / #1 = 3.81 CM 2.00 / 1.50 INCHES

2. Sample Analysis

	SCREEN SIZE	WT.%	ASH%	F.S.I.	CUM. WT.%	CUM. ASH%	HEAD ASH%	HEAD F.S.I.
FEED							12.1	7
O'FLOW	+65 Mesh	48.6	8.4	8	48.6	8.4	10.9	7
	65M x 0	51.4	13.3	5	100.0	10.9		
U'FLOW							38.3	1
S.B.O.							8.6	8
T.C.O.*							17.2	1/2

3. Yield - Total W.O. Cyclone Circuit = 95.6%

4. Estimated Yield of 28 x 65 Mesh Coal = 46.5%
(as % of 28 Mesh x 0 Feed)

5. Estimated 28M x 0 in circuit 0.886 M.T. 28.6 %
(Plant Feed - H.M. Products)

* Thickener Cyclone Overflow

Birtley Coal
& Minerals Testing

BULK WASHING DATA

FROTH FLOTATION CIRCUIT

ADIT/SEAM NO. BELCOURT 79-1-1 LAB. NO. 4179

1. Reagents: Kerosene:Methylisobutylcarbinol (MIBC)

2. Feed Pulp Density _____ g/l _____ % Solids W/V

3. Sample Analysis:-

	ASH	F.S.I.
FEED	12.4	5 1/2
CONC.	9.4	7
TAILS	38.4	1

4. Impeller Type - Birtley-Humboldt Multi-Wobble.

5. Yield Calculated (Ash Balance) 89.7 %

6. Filter Cake (Sieve Bend O'Flow & Flotation Conc.)
Wt. Recovered 0.644 M.T.

7. Filter Cake - Ash% 8.9 F.S.I. 7 1/2

Birtley Coal
& Minerals Testing

BULK WASHING DATA

SUMMARY

ADIT/SEAM NO. BELCOURT 79-1-1 LAB. NO. 4179 DATE OF WASH NOV 2, 1979

a) Raw Coal

Delivered Weight	=	M.T.
Ash%	= 13.7	
F.S.I.	= 7	
Estimated Washed Wt.	= 3.099	M.T.

b) Heavy Media Circuit

Estimated Proportion of +28 Mesh in Feed 71.4

Effective S.G. = 1.40

Raw Feed	14.4	% Ash	7	F.S.I.
Clean Coal	4.3	% Ash	8 1/2	F.S.I.
Reject	33.2	% Ash	1 1/2	F.S.I.
Calculated Yield	65.1	%		
Weighed Yield	64.9	%		

c) Water-Only Cyclone Circuit

Raw Feed	12.1	% Ash	7	F.S.I.
Overflow	10.9	% Ash	7	F.S.I.
Underflow	38.3	% Ash	1	F.S.I.
Calculated Yield	95.6			
% of +65M in O/F	48.6			
Sieve Bend Overflow	8.6	% Ash	8	F.S.I.

d) Froth Flotation Circuit

Raw Feed	12.4	% Ash	5 1/2	F.S.I.
Concentrates	9.4	% Ash	7	F.S.I.
Tails	38.4	% Ash	1	F.S.I.
Calculated Yield	89.7	%		

Birtley Coal & Minerals Testing

BULK WASHING DATA

BULK WASHING SUMMARY (cont.)

ADIT NO. BELCOURT 79-1-1 LAB. NO. 4179

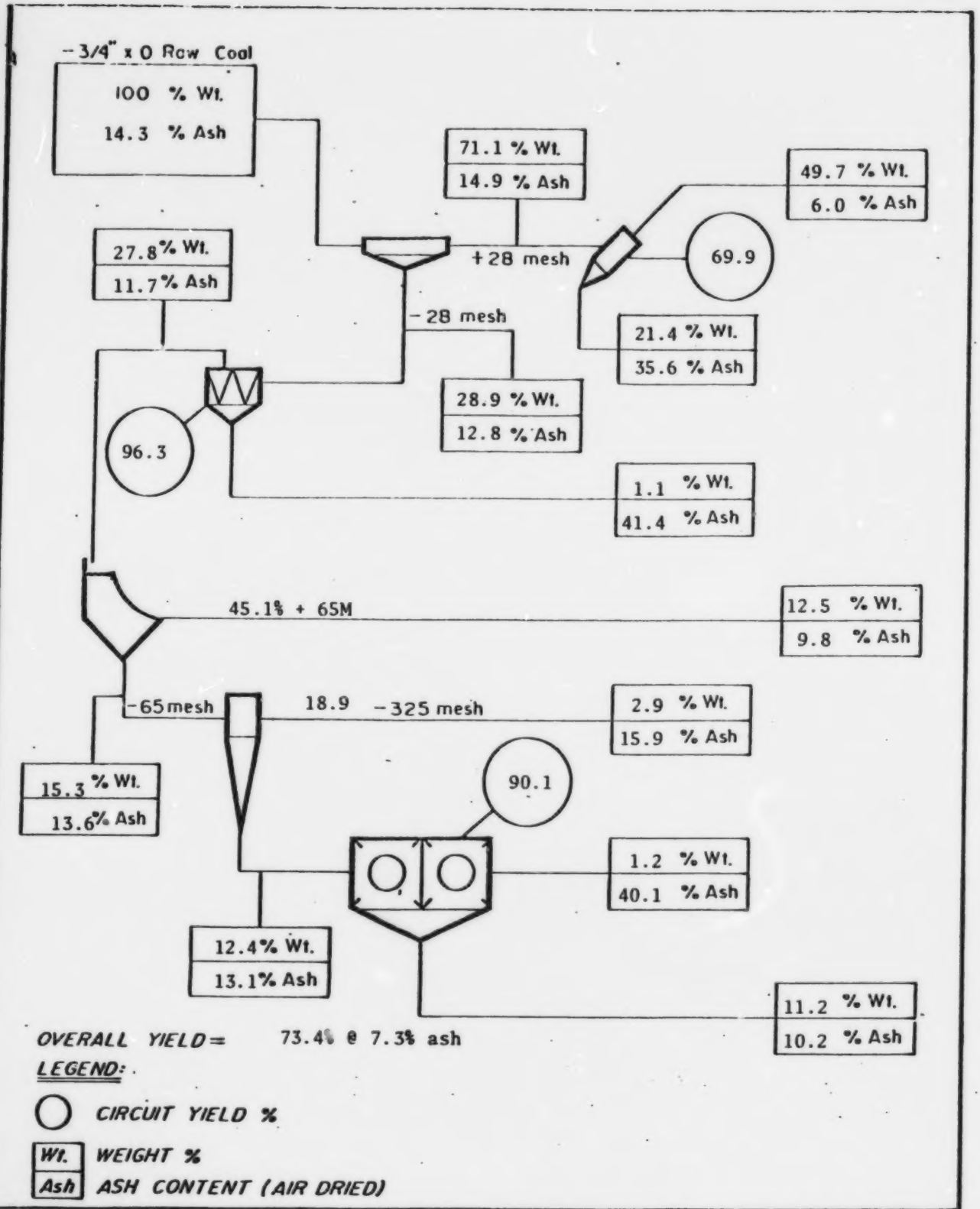
e) Clean Coal Mix Analysis, a.d.b.

i) Proximate Analysis:

ADM% 7.0 RM.% 0.4 ASH% 5.7 VM.% 24.4 FC.% 69.5

f) Clean Coal Mix Make Up

H.M. CLEAN COAL	FINES FILTER CAKE	CLEAN COAL MIX		SHIPPED		IN STOCK	
M.T.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.
1.436	0.644	12	2.080	--	--	--	--



BIRTLEY COAL & MINERALS TESTING

Title	PLANT BALANCE FLOW SHEET DSS FILE NO. 23SQ.23440-8-9127 BELCOURT 79-1-1 Medium Ash Coal LAB. NO. 4180A	Date SEPTEMBER, 1979 Drawn

BIRTLEY COAL & MINERALS TESTING

DSS FILE # 23SQ.23440-8-9127

BULK WASHING DATA*

MEDIUM ASH COAL

ADIT BELCOURT 79-1-1 SEAM _____ LAB. NO. 4180A

DELIVERY DATE AUGUST 12, 1979 DATE OF WASH SEPTEMBER 5, 1979

Raw Coal Analysis: ADM 3.7 ASH% 14.7 F.S.I. 7

Delivered Bulk Weight _____ Metric Tons

Washed Weight 8.046 Metric Tons

* All weight and analyses are on Air Dried Basis unless otherwise indicated.

Birtley Coal
& Minerals Testing
A DIVISION OF GREAT WEST STEEL INDUSTRIES LTD

BULK WASHING DATA

HEAVY MEDIUM CIRCUIT

ADIT/SEAM NO. BELCOURT 79-1-1 LAB. NO. 4180A

1. S.G. of Separation 1.45
2. Feed Ash Content 1.49 % F.S.I. 7
3. Clean Coal Estimated Weight 3.930 M.T.
4. Clean Coal Analysis - Ash 6.0 %F.S.I. 7
5. Reject Estimated Weight 1.791 M.T.
6. Reject Analysis - Ash 35.6 %F.S.I. 2
7. Estimated 3/4" x 28M in Circuit 5.721 M.T. 71.1 WT.%
8. Yield Clean Coal (Weighed) : 68.7 %
9. Yield Clean Coal (Calculated Ash Balance) - 69.9 %

Birtley Coal & Minerals Testing

A DIVISION OF GREAT WEST STEEL INDUSTRIES LTD

BULK WASHING DATA

WATER-ONLY CYCLONE CIRCUIT

ADIT/SEAM BELCOURT 79-1-1 LAB. NO. 4180A

1. Vortex Finder Clearance (VCF) #2 = 6.35 #1 = 0 CM 2.50 0 INCHES

2. Sample Analysis

	SCREEN SIZE	WT.%	ASH%	F.S.I.	CUM. WT.%	CUM. ASH%	HEAD ASH%	HEAD F.S.I.
FEED							12.8	6 1/2
O'FLOW	+65 Mesh	45.1	9.8	7 1/2	45.1	9.8	11.7	7
	65M x 0	54.9	13.3	4 1/2	100.0	11.7		
U'FLOW							41.4	1 1/2
S.B.O.							9.8	8
T.C.O.*							15.9	1

3. Yield - Total W.O. Cyclone Circuit = 96.3

4. Estimated Yield of 28 x 65 Mesh Coal = 43.4
(as % of 28 Mesh x 0 Feed)

5. Estimated 28M x 0 in circuit 2.325 M.T. 28.9 %
(Plant Feed - H.M. Products)

* Thickener Cyclone Overflow

Birtley Coal & Minerals Testing

A DIVISION OF GREAT WESTERN INDUSTRIES LTD

BULK WASHING DATA

FROTH FLOTATION CIRCUIT

ADIT/SEAM NO. BELCOURT 79-1-1 LAB. NO. 4180A

1. Reagents: Kerosene:Methylisobutylcarbinol (MIBC)

2. Feed Pulp Density _____ g/l _____ % Solids W/V

3. Sample Analysis:-

	ASH	F.S.I.
FEED	13.1	6 1/2
CONC.	10.2	7
TAILS	40.1	1

4. Impeller Type - Birtley-Humboldt Multi-Wobble.

5. Yield Calculated (Ash Balance) 90.1 %

6. Filter Cake (Sieve Bend O'Flow & Flotation Conc.)
Wt. Recovered 1.868 M.T.

7. Filter Cake - Ash% 10.0 F.S.I. 7 1/2

Birtley Coal
& Minerals Testing
A DIVISION OF GREAT WEST STEEL INDUSTRIES LTD

BULK WASHING DATA

SUMMARY

ADIT/SEAM NO. BELCOURT 79-1-1 LAB. NO. 4180A DATE OF WASH Sept 5, 1979

a) Raw Coal

Delivered Weight	= --	M.T.
Ash%	= 14.7	
F.S.I.	= 7	
Estimated Washed Wt.	= 8.046	M.T.

b) Heavy Media Circuit

Estimated Proportion of +28 Mesh in Feed 71.1%

Effective S.G. = 1.45

Raw Feed	14.9	% Ash	7	F.S.I.
Clean Coal	6.0	% Ash	7	F.S.I.
Reject	35.6	% Ash	2	F.S.I.
Calculated Yield	69.9	%		
Weighed Yield	68.7	%		

c) Water-Only Cyclone Circuit

Raw Feed	12.8	% Ash	6 1/2	F.S.I.
Overflow	11.7	% Ash	7	F.S.I.
Underflow	41.4	% Ash	1 1/2	F.S.I.
Calculated Yield	96.3	%		
% of +65M in O/F	45.1	%		
Sieve Bend Overflow	9.8	% Ash	8	F.S.I.

d) Froth Flotation Circuit

Raw Feed	13.1	% Ash	6 1/2	F.S.I.
Concentrates	10.2	% Ash	7	F.S.I.
Tails	40.1	% Ash	1	F.S.I.
Calculated Yield	90.1			

Birtley Coal & Minerals Testing

A DIVISION OF GREAT WEST STEEL INDUSTRIES LTD

BULK WASHING DATA

BULK WASHING SUMMARY (cont.)

ADIT/SEAM NO. BELCOURT 79-1-1 LAB. NO. 4180A

e) Clean Coal Mix Analyses

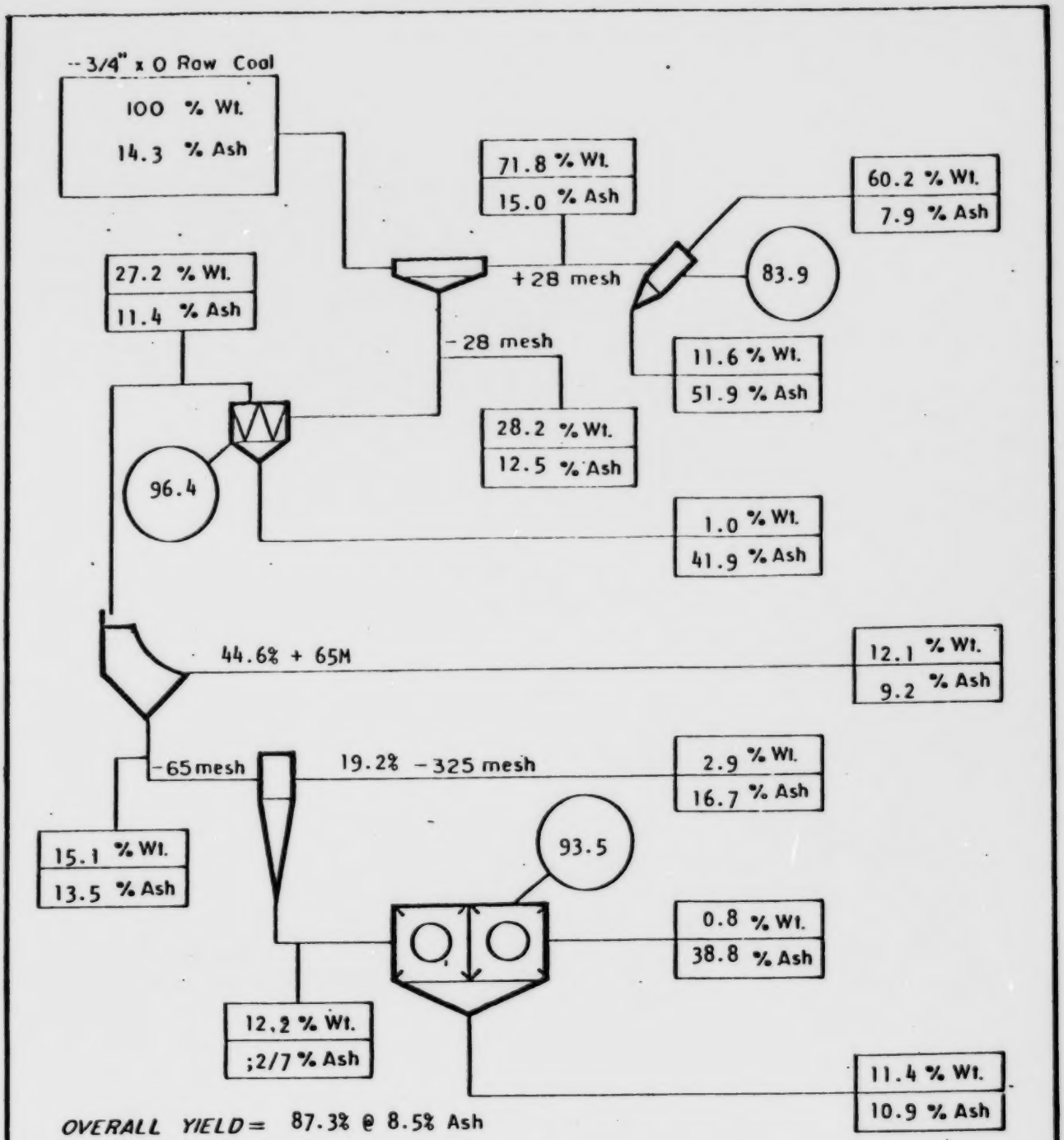
i) Proximate

ADM% 11.6 RM% 0.6 ASH% 7.3 VM% 23.9 FC% 68.2

S% 0.27 BTU/LB 14295 F.S.I. 7

f) Clean Coal Mix Make-Up

H.M. CLEAN COAL	FINES FILTER CAKE	CLEAN COAL MIX		SHIPPED		IN STOCK	
M.T.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.
3.930	1.868	34	5.798				



OVERALL YIELD = 87.3% @ 8.5% Ash

LEGEND:

○ *CIRCUIT YIELD %*

Wt.
Ash

WEIGHT %

ASH CONTENT (AIR DRIED)

BIRTLEY COAL & MINERALS TESTING

Title

PLANT BALANCE FLOW SHEET -
DSS FILE NO. DSS-23 SQ.23440-8-9127
BELCOURT 79-1-1 High Ash Coal
LAB.NO.: 4180

Date
November 1979

Drawn

BIRTLEY COAL & MINERALS TESTING

DSS-23 SO.23440-8-9127

BULK WASHING DATA*

HIGH ASH COAL

ADIT BELCOURT 79-1-1 SEAM _____ LAB. NO. 4180

DELIVERY DATE _____ DATE OF WASH November 2, 1979

Raw Coal Analysis: ADM 3.5 ASH% 14.3 F.S.I. 7

Delivered Bulk Weight --- Metric Tons

Washed Weight 2.347 Metric Tons

* All weight and analyses are on Air Dried Basis unless otherwise indicated.

Birtley Coal
& Minerals Testing

BULK WASHING DATA

HEAVY MEDIUM CIRCUIT

ADIT/SEAM NO. BELCOURT 79-1-1 LAB. NO. 4180

1. S.G. of Separation 1.60
2. Feed Ash Content 15.0 % F.S.I. 7
3. Clean Coal Estimated Weight 1.466 M.T.
4. Clean Coal Analysis - Ash 7.9 %F.S.I. 7
5. Reject Estimated Weight 0.284 M.T.
6. Reject Analysis - Ash 51.9 %F.S.I. 1
7. Estimated 3/4" x 28M in Circuit 1.750 M.T. 71.8 WT.%
8. Yield Clean Coal (Weighed) : 83.8 %
9. Yield Clean Coal (Calculated Ash Balance) - 83.9 %

Birtley Coal & Minerals Testing

A DIVISION OF GREAT WEST STEEL INDUSTRIES LTD

BULK WASHING DATA

WATER-ONLY CYCLONE CIRCUIT

ADIT/SEAM BELCOURT 79-1-1 LAB. NO. 4180

1. Vortex Finder Clearance (VCF) #2 = 5.08 #1 = 0 CM 2.00 0 INCHES

2. Sample Analysis

	SCREEN SIZE	WT.%	ASH%	F.S.I.	CUM. WT.%	CUM. ASH%	HEAD ASH%	HEAD F.S.I.
FEED							12.5	6 1/2
O'FLOW		44.6	9.2	7 1/2	44.6	9.2	11.4	7
		55.4	13.2	4 1/2	100.0	11.4		
U'FLOW							41.9	1 1/2
S.B.O.							9.2	8
T.C.O.*							16.7	1

3. Yield - Total W.O. Cyclone Circuit = 96.4%

4. Estimated Yield of 28 x 65 Mesh Coal = 43.0%
(as % of 28 Mesh x 0 Feed)

5. Estimated 28M x 0 in circuit 0.687 M.T. 28.2 %
(Plant Feed - H.M. Products)

* Thickener Cyclone Overflow

Birtley Coal
& Minerals Testing

BULK WASHING DATA

FROTH FLOTATION CIRCUIT

ADIT/SEAM NO. BELCOURT 79-1-1 LAB. NO. 4180

1. Reagents: Kerosene:Methylisobutylcarbinol (MIBC)

2. Feed Pulp Density _____ g/l _____ % Solids W/V

3. Sample Analysis:-

	ASH	F.S.I.
FEED	12.7	6 1/2
CONC.	10.9	7
TAILS	38,8	1

4. Impeller Type - Birtley-Humboldt Multi-Wobble.

5. Yield Calculated (Ash Balance) 93.5 %

6. Filter Cake (Sieve Bend O'Flow & Flotation Conc.)
Wt. Recovered 0.522 M.T.

7. Filter Cake - Ash% 10.0 F.S.I. 7 1/2

BULK WASHING DATA

SUMMARY

ADIT/SEAM NO. BELCOURT 79-1-1 LAB. NO. 4180 DATE OF WASH Nov. 2, 1979

a) Raw Coal

Delivered Weight	= --	M.T.
Ash%	= 14.3	
F.S.I.	= 7	
Estimated Washed Wt.	= 2.437	M.T.

b) Heavy Media Circuit

Estimated Proportion of +28 Mesh in Feed 71.8%

Effective S.G. = 1.60

Raw Feed	15.0 %	Ash	7	F.S.I.
Clean Coal	7.9 %	Ash	7	F.S.I.
Reject	51.9 %	Ash	1	F.S.I.
Calculated Yield	83.9 %			
Weighed Yield	83.8 %			

c) Water-Only Cyclone Circuit

Raw Feed	12.5 %	Ash	6 1/2	F.S.I.
Overflow	11.4 %	Ash	7	F.S.I.
Underflow	41.9 %	Ash	1 1/2	F.S.I.
Calculated Yield	96.4 %			
% of +65M in O/F	44.6 %			
Sieve Bend Overflow	9.2 %	Ash	8	F.S.I.

d) Froth Flotation Circuit

Raw Feed	12.7 %	Ash	6 1/2	F.S.I.
Concentrates	10.9 %	Ash	7	F.S.I.
Tails	38.8 %	Ash	1	F.S.I.
Calculated Yield	93.5 %			

Birtley Coal & Minerals Testing

A DIVISION OF GREAT WEST STEEL INDUSTRIES LTD

BULK WASHING DATA

BULK WASHING SUMMARY (cont.)

ADIT/SEAM NO. BELCOURT 79-1-1 LAB. NO. 4180

e) Clean Coal Mix Analyses

i) Proximate

ADM% 6.2 RM% 0.6 ASH% 8.4 VM% 23.8 FC% 67.2

ii) S% -- P% -- BTU/LB -- F.S.I. 7 H.G.I. --

f) Clean Coal Mix Make-Up

H.M. CLEAN COAL	FINES FILTER CAKE	CLEAN COAL MIX		SHIPPED		IN STOCK	
M.T.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.
1.466	0.522	12	1.988				

Birtley Coal & Minerals Testing

A DIVISION OF GREAT WEST STEEL INDUSTRIES LTD

PART 3

B.P. COAL

CLIENT : SUPPLY AND SERVICES, CANADA

PROJECT : DSS 23

SAMPLE : B.P. SUKUNKA COAL BULK SAMPLE

LAB NO. : 4386

JANUARY 14,1980

SIZE AND RAW ANALYSIS , a.d.b.					
				CUMULATIVE	
SIZE FRACTION	WT %	ASH %	F.S.I.	WT %	ASH %
3/4 " x 28 M	72.6	9.5	8	72.6	9.5
28 M x 65 M	14.6	5.1	9	87.2	8.8
65 M x 0	12.8	6.7	8 ½	100.0	8.5
HEAD RAW	100.0	8.9	8		
WT % + 3/4"	11.8 % crushed to pass 3/4"				

SINK - FLOAT ANALYSIS, a.d.b.										
	3/4" x 28M					28M x 65M				
				CUMULATIVE					CUMULATIVE	
S.G. FRACTION	WT %	ASH %	F.S.I.	WT%	ASH%	WT %	ASH %	F.S.I.	WT %	ASH%
-1.30	64.4	1.8	9	64.4	1.8	78.9	1.4	9 +	78.9	1.4
1.30-1.35	17.0	3.8	2	81.4	2.2	9.7	3.6	2 ½	88.6	1.6
1.35-1.40	2.7	7.6	1 ½	84.1	2.4	3.7	6.0	1	92.3	1.8
1.40-1.45	0.8	11.0	1 ½	84.9	2.5	0.9	11.0	1	93.2	1.9
1.45-1.50	0.5	14.7	1 ½	85.4	2.5	0.7	14.8	1	93.9	2.0
1.50-1.60	0.7	21.9	1	86.1	2.7	0.5	23.3	1	94.4	2.1
1.60-1.70	0.9	37.0	1	87.0	3.1	0.6	35.1	½	95.0	2.3
1.70-1.80	6.7	47.8	½	93.7	6.3	1.8	45.7	½	96.8	3.1
1.80-2.00	4.9	53.5	½	98.6	8.6	1.9	53.1	½	98.7	4.1
+2.00	1.4	84.0	0	100.0	9.7	1.3	84.6	0	100.0	5.1

Birtley Coal
& Minerals Testing

CLIENT : SUPPLY AND SERVICES, CANADA JAN.14/80

PROJECT : DSS 23

SAMPLE : B.P. SUKUNKA COAL BULK SAMPLE

LAB NO.: 4386

FROTH FLOTATION TEST					
65 M x 0 (P.D. =10%)					
PRODUCT	WT %	ASH %	F.S.I.	CUMULATIVE WT%	CUMULATIVE ASH%
STAGE 1	80.6	3.2	9	80.6	3.2
STAGE 11	8.9	6.5	8 ½	89.5	3.5
TAILS	10.5	29.6	2	100.0	6.3

FROTH FLOAT PARAMETERS:

Reagent -4:1 = Ker: M1BC

Dosage -0.48 lb/T.D.S.

Conditioning Time-1 minute

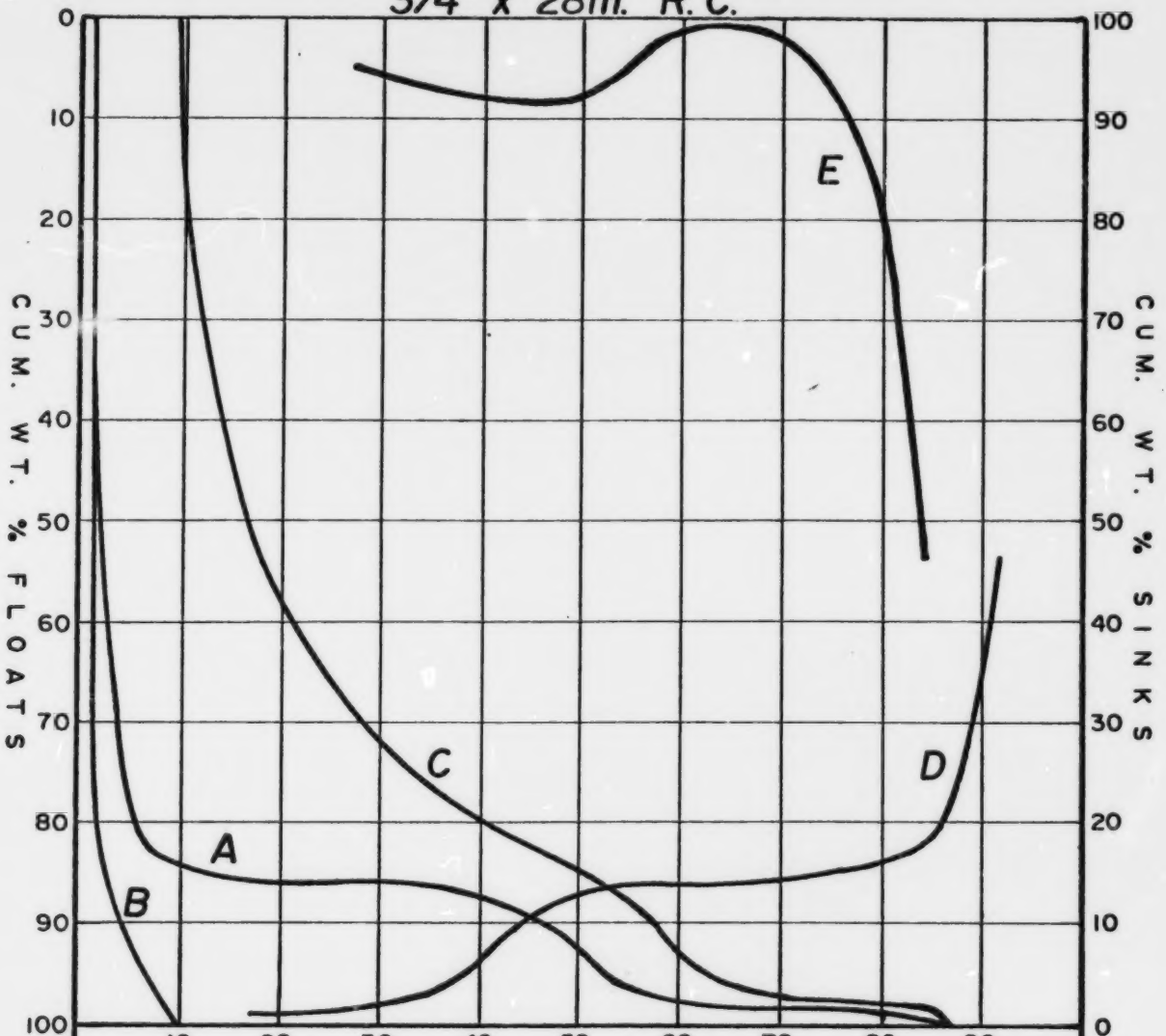
Stage 1 -1st minute froth

Stage 11 -2nd minute froth

Birtley Coal
& Minerals Testing
A DIVISION OF GREAT WEST STEEL INDUSTRIES LTD

WASHABILITY CURVES

3/4" x 28m. R.C.



A – PRIMARY CURVE
B – CLEAN COAL CURVE
C – DISCARD CURVE
D — S.G. – YIELD CURVE
E — + 0.1 S.G. DISTRIBUTION CURVE

BIRTLEY COAL and MINERALS TESTING
calgary alberta

CLIENT: *DEPARTMENT OF SUPPLY AND SERVICES*

SAMPLE: *D.S.S. 23 BULK SAMPLE – B.P. SUKUNKA COAL*

LAB NO: 4386 | DRAWN BY: *A.* | DATE: *JAN. 1980*

CLIENT: DEPARTMENT OF SUPPLY & SERVICES

SAMPLE: D.S.S. 23 Bulk Sample - B.P. SUKUNKA COAL

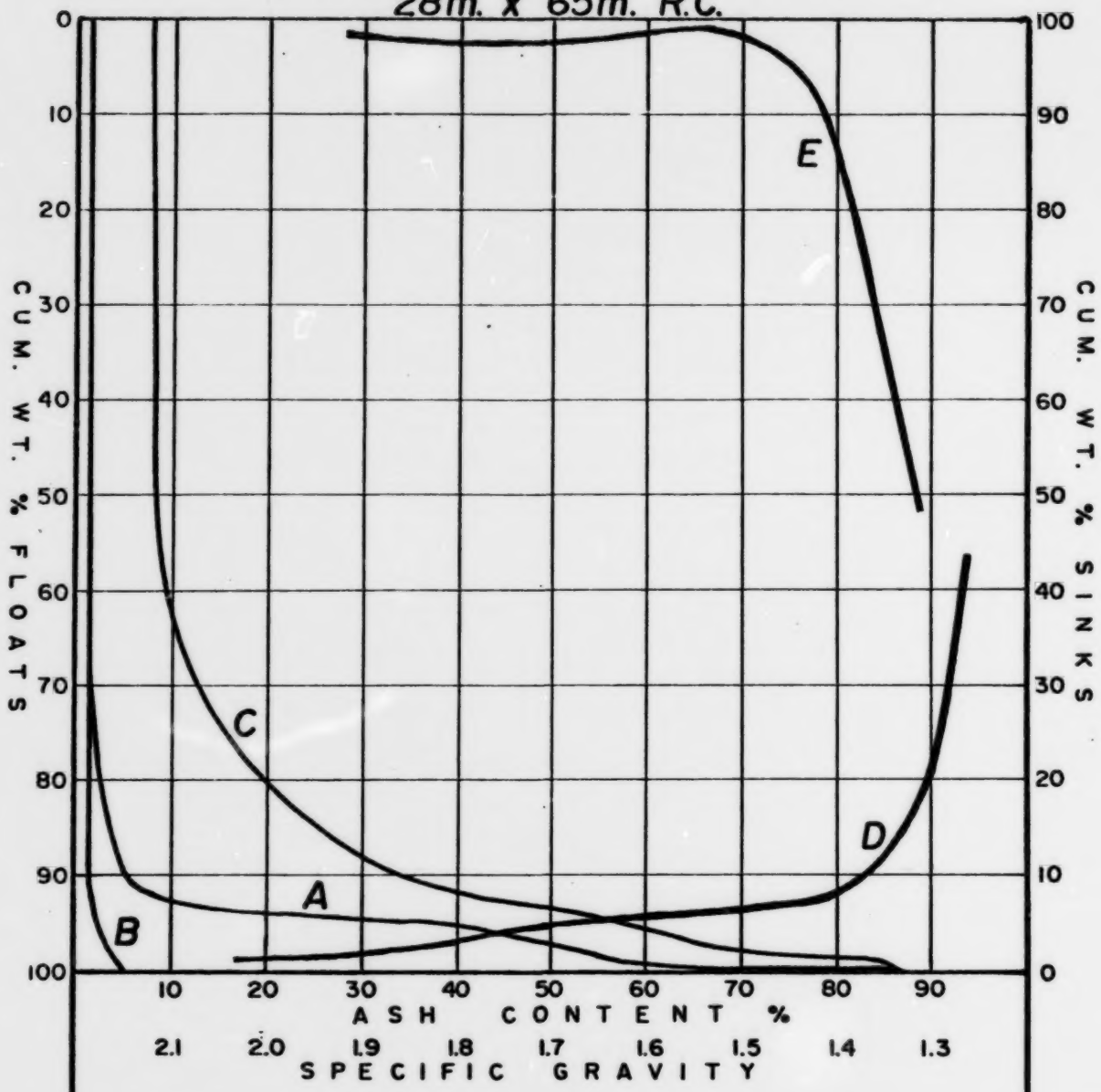
LAB NO: 4386 JAN. /80

WASHABILITY DATA: 3/4" x 28M RAW COAL FROM SINK FLOAT ANALYSIS

SPECIFIC GRAVITY FRACTION	DIRECT		% WT. of Ash of Total	Cum. Wt.of Ash %	CUMULATIVE FLOATS		SINK WT.of ASH%	CUMULATIVE SINKS		+0.1 S.G. DISTRIBUTION	
	WT%	ASH%			WT%	ASH%		WT %	ASH%	S.G.	WT%
-1.30	64.4	1.8	1.2	1.2	64.4	1.8	8.5	35.6	23.9		
1.30 -1.35	17.0	3.8	0.6	1.8	81.4	2.2	7.9	18.6	42.5		
1.35 -1.40	2.7	7.6	0.2	2.0	84.1	2.4	7.7	15.9	48.4	1.40	21.0
1.40 -1.45	0.8	11.0	0.1	2.1	84.9	2.5	7.6	15.1	50.3	1.45	7.2
1.45 -1.50	0.5	14.7	0.1	2.2	85.4	2.5	7.5	14.6	51.4	1.50	2.0
1.50 -1.60	0.7	21.9	0.2	2.4	86.1	2.7	7.3	13.9	52.5	1.60	1.6
1.60 -1.70	0.9	37.0	0.3	2.7	87.0	3.1	7.0	13.0	53.8	1.70	7.6
1.70 -1.80	6.7	47.8	3.2	5.9	93.7	6.3	3.8	6.3	60.3	1.80	8.0
1.80 -2.00	4.9	53.5	2.6	8.5	98.6	8.6	1.2	1.4	85.7	1.90	4.9
+2.00	1.4	84.0	1.2	9.7	100.0	9.7					

WASHABILITY CURVES

28m. x 65m. R.C.



A – PRIMARY CURVE
B – CLEAN COAL CURVE
C – DISCARD CURVE
D — S.G. – YIELD CURVE
E — + 0.1 S.G. DISTRIBUTION CURVE

BIRTLEY COAL and MINERALS TESTING
calgary alberta

CLIENT: *DEPARTMENT OF SUPPLY AND SERVICES*

SAMPLE: *D.S.S. 23 BULK SAMPLE – B.P. SUKUNKA COAL*

LAB NO: 4386	DRAWN BY: *A.*	DATE: *JAN. 1980*

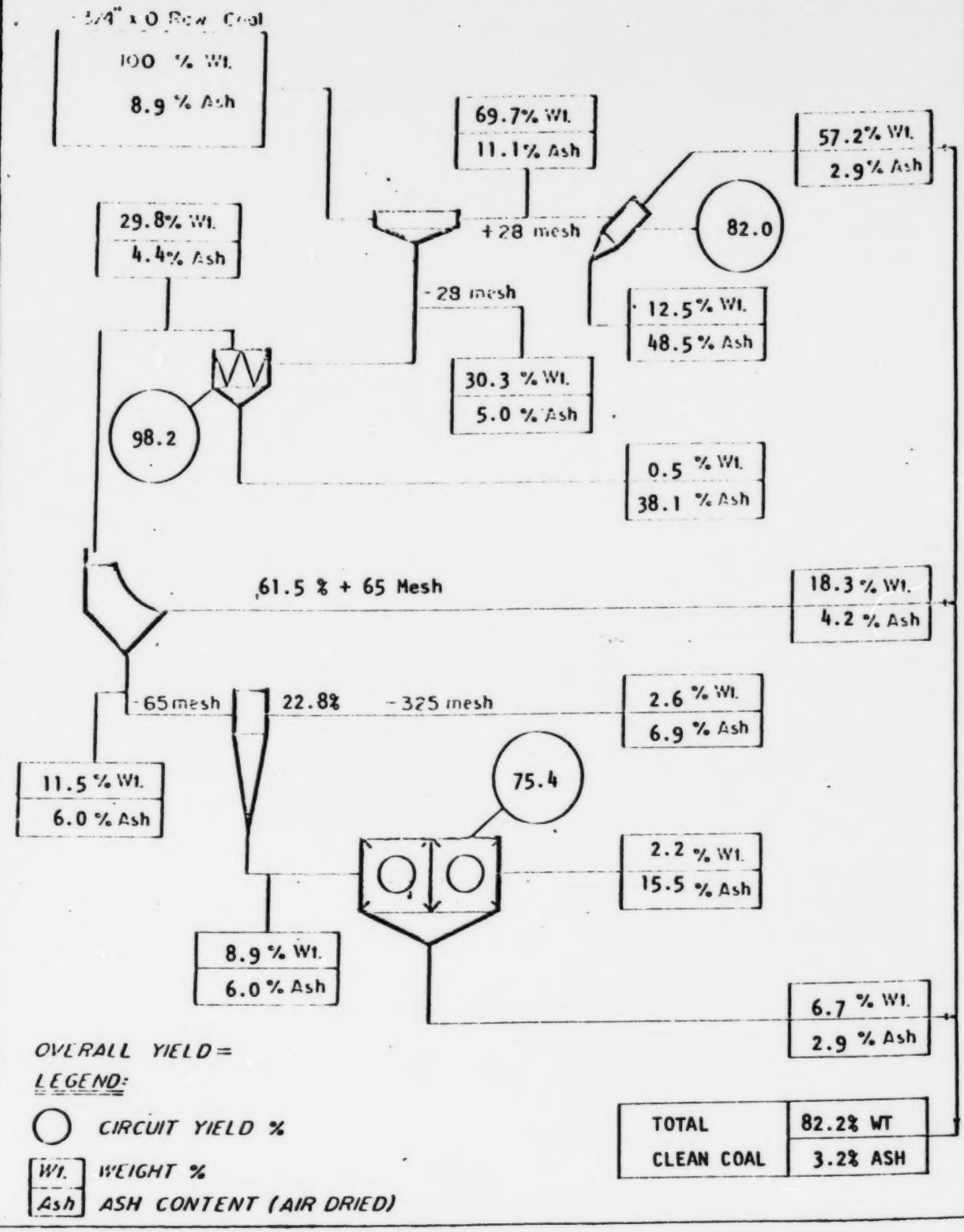
CLIENT: DEPARTMENT OF SUPPLY & SERVICES

SAMPLE: D.S.S. 23 Bulk Sample - B.P. SUKUNKA COAL

LAB NO: 4386

WASHABILITY DATA: 28M x 65M RAW COAL FROM SINK FLOAT ANALYSIS

SPECIFIC GRAVITY FRACTION	DIRECT		% WT. of Ash of Total	Cum. Wt.of Ash %	CUMULATIVE FLOATS		SINK WT.of ASH%	CUMULATIVE SINKS		+0.1 S.G. DISTRIBUTION	
	WT%	ASH%			WT%	ASH%		WT %	ASH%	S.G.	WT%
-1.30	78.9	1.4	1.1	1.1	78.9	1.4	4.0	21.1	19.0		
1.30 -1.35	9.7	3.6	0.4	1.5	88.6	1.6	3.6	11.4	31.6		
1.35 -1.40	3.7	6.0	0.2	1.7	92.3	1.8	3.4	7.7	44.2	1.40	15.0
1.40 -1.45	0.9	11.0	0.1	1.8	93.2	1.9	3.3	6.8	48.5	1.45	4.8
1.45 -1.50	0.7	14.8	0.1	1.9	93.9	2.0	3.2	6.1	52.5	1.50	2.1
1.50 -1.60	0.5	23.3	0.1	2.0	94.4	2.1	3.1	5.6	55.4	1.60	1.1
1.60 -1.70	0.6	35.1	0.2	2.2	95.0	2.3	2.9	5.0	58.0	1.70	2.4
1.70 -1.80	1.8	45.7	0.8	3.0	96.8	3.1	2.1	3.2	65.6	1.80	2.7
1.80 -2.00	1.9	53.1	1.0	4.0	98.7	4.1	1.1	1.3	84.6	1.90	1.9
+2.00	1.3	84.6	1.1	5.1	100.0	5.1					



BIRTLEY COAL & MINERALS TESTING

Title	PLANT BALANCE FLOWSHEET DEPARTMENT OF SUPPLY & SERVICES DSS 23 BULK SAMPLE -BP SUKUNKA COAL LOW ASH CLEAN COAL LAB NO. 4422	Date JAN. 30/80 Drawn

SUMMARY - BULK WASHING DATA *

Bulk Sample DSS 23 Low Ash Clean Coal-BP SUKUNKA Lab. No. 4422

Date Received January 11, 1980 Date Washed January 28, 1980

(a) RAW COAL

Delivered Weight 11.810 MT Washed Weight 3.885 MT

ADM % 3.0 ASH% 8.9 F.S.I. 8

(b) HEAVY MEDIA CIRCUIT: 3/4" x 28 Mesh= 69.7 % by weight

S.G. of Medium 1.25 Calculated Yield 82.0 %

Sample	ASH %	F.S.I.
Feed	11.1	7 1/2
Clean Coal	2.9	8 1/2
Reject	48.5	1

(c) WATER -ONLY CYCLONE CIRCUIT :28M x0 = 30.3 % by weight

V.F.C. #1 2.54 C.M. #2 5.08 C.M. Calculated Yield 98.2%

Sample	ASH %	F.S.I.
Feed	5.0	8 1/2
Overflow	4.4	9
Underflow	38.1	3
S.B.O.	4.2	9
S.B.U.	6.0	8 1/2

(d) FROTH FLOTATION CIRCUIT: 65M x0 11.5 %by Weight

4:1 =Kerosene: M.I.B.C. Calculated Yield 75.4 %

Sample	ASH %	F.S.I.
T.C.O.	6.9	7
Feed (T.C.U.)	6.0	8 1/2
Concentrate	2.9	9
Tailings	15.5	7 1/2

(e) FILTER CAKE : S.B.O. + CONCENTRATE = 4.0 ASH % 9 FSI

*All weights and analyses are on an Air Dried Basis unless otherwise indicated

Birtley Coal & Minerals Testing

A DIVISION OF GREAT WESTERN STEEL INDUSTRIES LTD

SUMMARY - BULK WASHING DATA (Cont.)

BULK SAMPLE DSS 23 Low Ash Clean Coal - B.P. SUKUNKA LAB NO. 4422

(f) CLEAN COAL: H.M.C.C. + FILTER CAKE Calculated Yield 32.2

	PROXIMATE								
ADM	RM%	ASH%	VM %	FC %	S	BTU	FSI	P	
6.6	0.3	3.3	23.0	73.4			8 1/2		

CLEAN COAL INVENTORY

DATE	SHIPPED		IN STOCK	
	BBLS	M.T.	BBLS	M.T.
February 1/80			18	3.094

GIESELER FLUIDITY TEST		
	DDPM	TEMP(°C)
START		
MAXIMUM		
FINAL		
RANGE		

Birtley Coal
& Minerals Testing

BULK WASHING DATA

BULK SAMPLE DSS 23 Low Ash Clean Coal B.P. SUKUNKA LAB NO. 4422

HEAVY MEDIUM CIRCUIT

CYCLONE: 14" DSM operating @ 51.7 KPa.

MAGNETITE MEDIUM maintained @ 1.25 S.G.

1.	FEED(3/4 x 28 Mesh)	2.708	M.T.	11.1	ASH%	7 1/2	FSI
2.	CLEAN COAL	2.202	M.T.	2.9	ASH%	8 1/2	FSI
3.	REJECT	0.506	M.T.	48.5	ASH%	1	FSI

4. YIELD CLEAN COAL (Weighted) = $\frac{2.202}{2.708}$ = 81.3 %

5. YIELD CLEAN COAL (Calculated)= $\frac{48.5-11.1}{48.5-2.9}$ = 82.0 %

Birtley Coal
& Minerals Testing

BULK WASHING DATA

Bulk Sample DSS23 Low Ash Clean Coal- B.P. SUKUNKA LAB NO. 4422

WATER - ONLY CYCLONE CIRCUIT

Primary Cyclone: 6" DSM operating @ 137.9 KPa

Vortex Finder Clearance set @ 2.54 CM

Secondary Cyclone: 4" DSM operating@ 34.5 KPa

Vortex Finder Clearance set @ 5.08 CM

Sieve Bend : 65 Mesh

1.	Feed (28 Mesh x 0)	5.0	ASH	%	8 1/2	FSI
2.	Primary Cyclone Overflow	4.4	ASH	%	9	FSI
3.	Secondary Cyclone Underflow	38.1	ASH	%	3	FSI
4.	Sieve Bend Overflow(S.B.O.)	4.2	ASH	%	9	FSI
5.	Sieve Bend Underflow(S.B.U.)	6.0	ASH	%	8 1/2	FSI
6.	Yield (W.O. Cyclone)	$\frac{38.1 - 5.0}{38.1 - 4.4}$	=		98.2	%
7.	WT% 28Mx65M in Primary Cyclone Overflow		=		61.5	%
8.	Estimated Yield of 28M x65M (S.B.O. , as % of 28 M x 0 Feed)		=		60.4	%

Birtley Coal & Minerals Testing

BULK WASHING DATA

BULK SAMPLE DSS23 Low Ash Clean Coal LAB NO. 4422
B.P. SUKUNKA

FROTH FLOTATION CIRCUIT

Flotation Cell: two(2) Birtley -Humboldt Multi-Wobble impellers in series.

Reagent : 4:1 = Kerosene:M.I.B.C.

Thickening Cyclone : 20° - 8" cyclone Hayl-Patterson

1. Thickening Cyclone Overflow (T.C.O. -325M) 6.9 ASH% 7 FSI

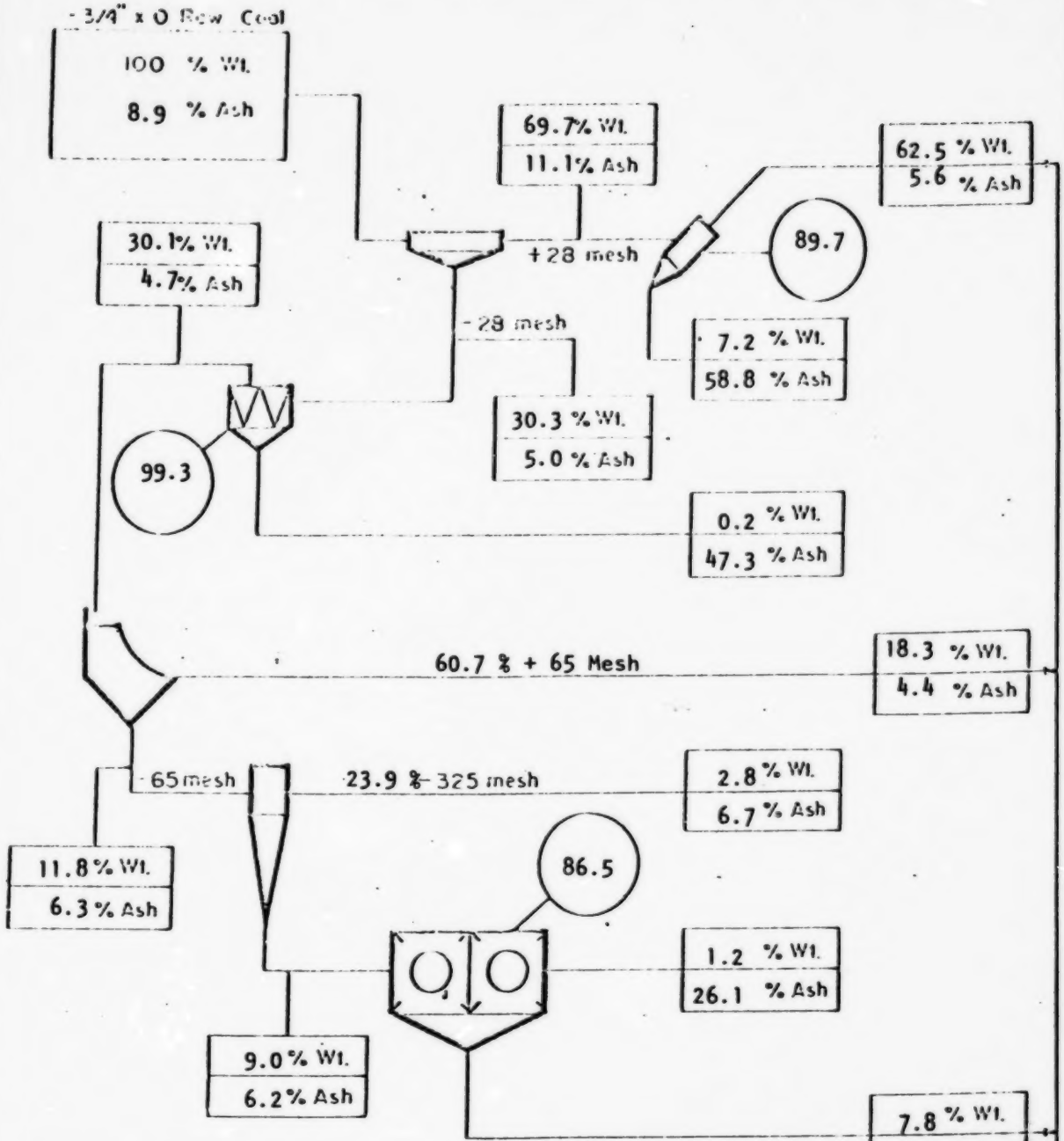
2. Flotation Feed(Thickening Cyclone Underflow) 6.0 ASH% 8 1/2 FSI

3. Concentrate 2.9 ASH% 9 FSI

4. Tailings 15.5 ASH% 7 1/2 FSI

5. Yield Concentrate $\frac{15.5 - 6.0}{15.5 - 2.9} = 75.4$ %

Birtley Coal
& Minerals Testing



BIRTLEY COAL & MINERALS TESTING

Title	PLANT BALANCE FLOWSHEET DEPARTMENT OF SUPPLY & SERVICES DSS 23 BULK SAMPLE - B.P. SUKUNKA COAL MEDIUM ASH CLEAN COAL LAB NO. 4423	Date FEB. 4, 1980 Drawn

SUMMARY - BULK WASHING DATA *

Bulk Sample DSS23 Medium Ash Clean Coal-BP SUKUNKA Lab. No. 4423

Date Received January 11, 1980 Date Washed January 30, 1980

(a) RAW COAL

Delivered Weight 11.810 MT Washed Weight 3.395 MT

ADM % 3.0 ASH% 8.9 F.S.I. 8

(b) HEAVY MEDIA CIRCUIT: 3/4" x 28 Mesh= 69.7 % by weight

S.G. of Medium 1.56 Calculated Yield 89.7 %

Sample	ASH %	F.S.I.
Feed	11.1	7 1/2
Clean Coal	5.6	8
Reject	58.8	1/2

(c) WATER -ONLY CYCLONE CIRCUIT :28M x0 = 30.3 % by weight

V.F.C. #1 0 #2 5.08 CM Calculated Yield 99.3%

Sample	ASH %	F.S.I.
Feed	5.0	8 1/2
Overflow	4.7	9
Underflow	47.3	1 1/2
S.B.O.	4.4	9
S.B.U.	6.3	8 1/2

(d) FROTH FLOTATION CIRCUIT: 65M x0 11.8 %by Weight

4:1 =Kerosene: M.I.B.C. Calculated Yield 86.5%

Sample	ASH %	F.S.I.
T.C.O.	6.7	7 1/2
Feed (T.C.U.)	6.2	8 1/2
Concentrate	3.1	9
Tailings	26.1	5 1/2

(e) FILTER CAKE : S.B.O. + CONCENTRATE = 4.2 ASH % 9 FSI

*All weights and analyses are on an Air Dried Basis unless otherwise indicated

Birtley Coal & Minerals Testing

A DIVISION OF GREAT WEST STEEL INDUSTRIES LTD

SUMMARY -BULK WASHING DATA (Cont.)

BULK SAMPLE DSS23 Medium Ash Clean Coal -BP Sukunka LAB NO. 4423

(f) CLEAN COAL: H.M.C.C. + FILTER CAKE. Calculated Yield 88.6

	PROXIMATE								
ADM	RM%	ASH%	VM %	FC %	S	BTU	FSI	P	
4.6	0.4	5.2	22.7	71.7			8 1/2		

DILATATION TEST				
ST (°C)	MDT (°C)	MC %	MD %	G

GIESELER FLUIDITY TEST		
	DDPM	TEMP (°C)
START		
MAXIMUM		
FINAL		
RANGE		

Birtley Coal & Minerals Testing

A DIVISION OF GREAT WEST STEEL INDUSTRIES LTD

BULK WASHING DATA

BULK SAMPLED SS23 Medium Ash Clean Coal LAB NO: 4423

B.P. SUKUNKA

HEAVY MEDIUM CIRCUIT

CYCLONE: 14" DSM operating @ 51.7 KPa.

MAGNETITE MEDIUM maintained @ 1.56 S.G.

1.	FEED(3/4 x 28 Mesh)	2.366	M.T.	11.1	ASH%	7 1/2	FSI
2.	CLEAN COAL	2.108	M.T.	5.6	ASH%	8	FSI
3.	REJECT	0.258	M.T.	58.8	ASH%	1/2	FSI

4. YIELD CLEAN COAL (Weighted) = $\frac{2.108}{2.366}$ = 89.1 %

5. YIELD CLEAN COAL (Calculated)= $\frac{58.8 = 11.1}{58.8 = 5.6}$ = 89.7 %

Birtley Coal
& Minerals Testing
A DIVISION OF GREAT WEST STEEL INDUSTRIES LTD

BULK WASHING DATA

Bulk Sample DSS23 Medium Ash Clean Coal LAB NO. 4423

B.P. SUKUNKA

WATER - ONLY CYCLONE CIRCUIT

Primary Cyclone: 6" DSM operating @ 137.9 KPa

Vortex Finder Clearance set @ 0 CM

Secondary Cyclone: 4" DSM operating@ 34.5 KPa

Vortex Finder Clearance set @ 5.08 CM

Sieve Bend : 65 Mesh

1.	Feed (28 Mesh x 0)	5.0	ASH %	8 1/2	FSI
2.	Primary Cyclone Overflow	4.7	ASH %	9	FSI
3.	Secondary Cyclone Underflow	47.3	ASH %	1 1/2	FSI
4.	Sieve Bend Overflow(S.B.O.)	4.4	ASH %	9	FSI
5.	Sieve Bend Underflow(S.B.U.)	6.3	ASH %	8 1/2	FSI
6.	Yield (W.O. Cyclone)	$\frac{47.3 - 5.0}{47.3 - 4.7}$	=	99.3	%
7.	WT% 28Mx65M in Primary Cyclone Overflow		=	60.7	%
8.	Estimated Yield of 28M x65M (S.B.O. , as % of 28 M x 0 Feed)		=	60.3	%

Birtley Coal
& Minerals Testing

BULK WASHING DATA

BULK SAMPLED SS 23 Medium Ash Clean Coal LAB NO. 4423
B.P. SUKUNKA

FROTH FLOTATION CIRCUIT

Flotation Cell: two(2) Birtley -Humboldt Multi-Wobble impellers in series.

Reagent : 4:1 = Kerosene:M.I.B.C.

Thickening Cyclone : 20° - 8" cyclone Hayl-Patterson

1. Thickening Cyclone Overflow (T.C.O. -325M) 6.7 ASH% 7 1/2 FSI

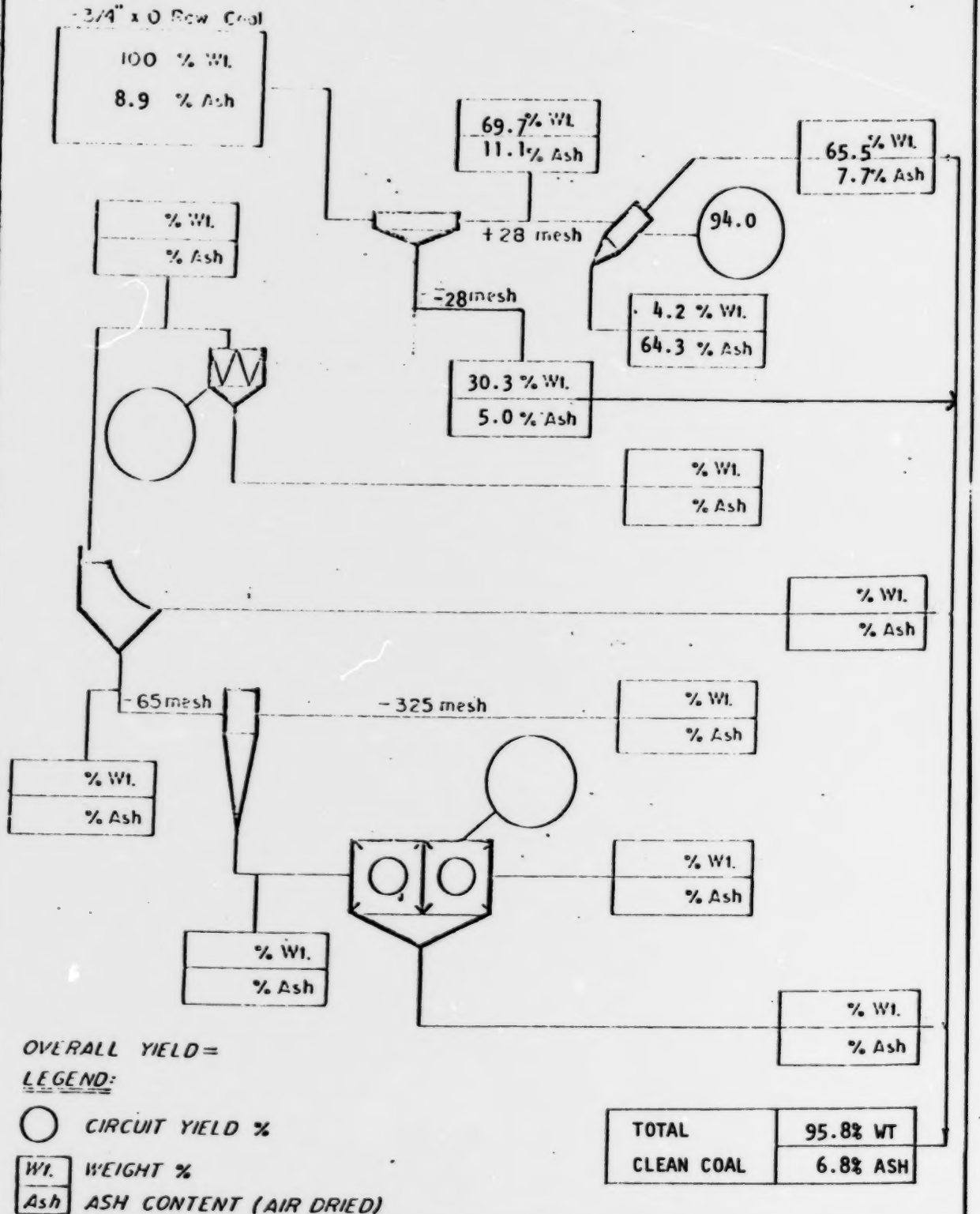
2. Flotation Feed(Thickening Cyclone Underflow) 6.2 ASH% 8 1/2 FSI

3. Concentrate 3.1 ASH% 9 FSI

4. Tailings 26.1 ASH% 5 1/2 FSI

5. Yield Concentrate $\frac{26.1 = 6.2}{26.1 = 3.1}$ = 86.5 %

Birtley Coal
& Minerals Testing



BIRTLEY COAL & MINERALS TESTING

Title	PLANT BALANCE FLOWSHEET DEPARTMENT OF SUPPLY & SERVICES DSS 23 BULK SAMPLE -B.P. SUKINKA COAL HIGH ASH CLEAN COAL LAB NO. 4424	Date FEB. 7, 1980 Drown

SUMMARY - BULK WASHING DATA *

Bulk Sample DSS 23 HIGH ASH CLEAN COAL-BP SUKUNKA Lab. No. 4424

Date Received January 11, 1980 Date Washed February 1, 1980

(a) RAW COAL

Delivered Weight 11.810 MT Washed Weight 3.112 MT

ADM % 3.0 ASH% 8.9 F.S.I. 8

(b) HEAVY MEDIA CIRCUIT: 3/4" x 28 Mesh= 69.7 % by weight

S.G. of Medium 1.63 Calculated Yield 94.0 %

Sample	ASH %	F.S.I.
Feed	11.1	7 1/2
Clean Coal	7.7	8
Reject	64.3	1/2

(c) WATER -ONLY CYCLONE CIRCUIT :28M x0 = _____ % by weight

V.F.C. #1 _____ #2 _____ Calculated Yield _____

Sample	ASH %	F.S.I.
Feed		
Overflow		
Underflow		
S.B.O.		
S.B.U.		

(d) FROTH FLOTATION CIRCUIT: 65M x0 _____ %by Weight

4:1 =Kerosene: M.I.B.C. Calculated Yield _____

Sample	ASH %	F.S.I.
T.C.O.		
Feed (T.C.U.)		
Concentrate		
Tailings		

(e) FILTER CAKE : 28Mx0 RAW(30.3% by Weight) 5.0 ASH % 8 1/2 FSI

*All weights and analyses are on an Air Dried Basis unless otherwise indicated

Birtley Coal & Minerals Testing

A DIVISION OF GREAT WEST STEEL INDUSTRIES LTD

SUMMARY -BULK WASHING DATA (Cont.)

BULK SAMPLE DSS 23 High Ash Clean Coal-BP SUKUNKA LAB NO. 4424

(f) CLEAN COAL: H.M.C.C. + FILTER CAKE Calculated Yield 96.2

	PROXIMATE								
ADM	RM%	ASH%	VM %	FC %	S	BTU	FSI	P	
6.1	0.4	6.8	22.3	70.5			8 1/2		

DILATATION TEST				
ST (°C)	MDT (°C)	MC %	MD %	G

GIESELER FLUIDITY TEST		
	DDPM	TEMP (°C)
START		
MAXIMUM		
FINAL		
RANGE		

Birtley Coal
& Minerals Testing

BULK WASHING DATA

BULK SAMPLE DSS23 High Ash Clean Coal LAB NO. 4424
B.P. SUKUNKA

HEAVY MEDIUM CIRCUIT

CYCLONE: 14" DSM operating @ 51.7 KPa.

MAGNETITE MEDIUM maintained @ 1.63 S.G.

1. FEED(3/4 x 28 Mesh) 2.169 M.T. 11.1 ASH% 7 1/2 FSI

2. CLEAN COAL 2.040 M.T. 7.7 ASH% 8 FSI

3. REJECT 0.129 M.T. 64.3 ASH% 1/2 FSI

4. YIELD CLEAN COAL (Weighted) = $\frac{2.040}{2.169}$ = 94.1 %

5. YIELD CLEAN COAL (Calculated)= $\frac{64.3 - 11.1}{64.3 - 8.0}$ = 94.0 %

Birtley Coal
& Minerals Testing

CLIENT : ENERGY MINES & RESOURCES CANMET FEB.9/80

PROJECT : B.P. SUKUNKA BULK SAMPLE MEDIUM ASH CLEAN COAL

D.S.S. 23

LAB NO. : 4423

SINK-FLOAT ANALYSIS:- H.M. REJECT #1

S.G. FRACTION	WT %	ASH %	CUMULATIVE WT %	CUMULATIVE ASH %
- 1.80	54.1	47.7	54.1	47.7
+ 1.80	45.9	59.1	100.0	52.9

Birtley Coal
& Minerals Testing

CLIENT: ENERGY MINES & RESOURCES CANMET
PROJECT: B. P. SUKUNKA BULK SAMPLE HIGH ASH CLEAN COAL FEB.5/80
DSS 23
LAB NO. 4424

SINK-FLOAT ANALYSIS: H.M. CLEAN COAL # 2

S.G. FRACTION	WT %	ASH %	CUMULATIVE	
			WT %	ASH %
-1.80	75.1	46.1	75.1	46.1
1.80 -1.85	21.7	52.0	96.8	47.4
1.85 -1.90	2.7	54.4	99.5	47.6
+1.90	0.5	55.4	100.0	47.7

SINK-FLOAT ANALYSIS: H.M. REJECT # 2

S.G. FRACTION	WT %	ASH %	CUMULATIVE	
			WT %	ASH %
-1.80	10.9	50.1	10.9	50.1
1.80 -1.85	31.3	52.9	42.2	52.2
1.85 -1.90	19.4	55.2	61.6	53.1
+1.90	38.4	80.4	100.0	63.6

Birtley Coal
& Minerals Testing
A DIVISION OF GREAT WEST STEEL INDUSTRIES LTD

PART 4

FORDING COAL

CLIENT: DEPT. OF SUPPLY & SERVICES

PROJECT: DSS 23

SAMPLE : BULK SAMPLE - FORDING COAL

LAB NO.: 4549

FEBRUARY 14,1980

SIZE AND RAW ANALYSIS , a.d.b.					
				CUMULATIVE	
SIZE FRACTION	WT %	ASH %	FSI	WT%	ASH %
3/4" x 28 M	69.4	32.9	5 1/2	69.4	32.9
28 M x 65 M	14.0	17.2	8 1/2	83.4	30.3
65 M x 0	16.6	14.0	8 1/2	100.0	27.6
HEAD RAW	100.0	27.9	7		
WT % + 3/4 "	27.6 crushed to pass 3/4 "				

SINK - FLOAT ANALYSIS , a.d.b.										
	3/4 " x 28M					28 M x 65 M				
				CUMULATIVE					CUMULATIVE	
S.G. FRACTION	WT %	ASH %	FSI	WT %	ASH%	WT%	ASH %	FSI	WT %	ASH%
-1.30	45.2	3.3	8 1/2	45.2	3.3	52.1	2.4	9	52.1	2.4
1.30 -1.35	7.6	11.1	6 1/2	52.8	4.4	12.3	5.6	8 1/2	64.4	3.0
1.35 -1.40	3.4	16.3	5	56.2	5.1	4.5	9.9	7 1/2	68.9	3.5
1.40 -1.45	2.4	21.2	4 1/2	58.6	5.8	4.2	12.3	7 1/2	73.1	4.0
1.45 -1.50	1.9	27.4	3 1/2	60.5	6.5	3.0	16.2	6 1/2	76.1	4.5
1.50 -1.60	3.0	35.3	3 1/2	63.5	7.8	3.8	22.7	4 1/2	79.9	5.3
1.60 -1.70	3.3	43.4	3 1/2	66.8	9.6	5.6	30.1	3	85.5	6.9
1.70 -1.80	2.6	51.3	3	69.4	11.2	2.0	49.2	1	87.5	7.9
1.80 -1.90	4.8	60.6	1	74.2	14.4	2.8	59.4	1	90.3	9.5
+1,90	25.8	83.1	N.A.	100.0	32.1	9.7	82.0	N.A.	100.0	16.5

Birtley Coal
& Minerals Testing

A DIVISION OF GREAT WEST STEEL INDUSTRIES LTD

CLIENT: DEPT. OF SUPPLY AND SERVICES

PROJECT: DSS 23

FEBRUARY 14,1980

SAMPLE:BULK FORDING COAL SAMPLE

LAB NO. : 4549

FROTH FLOTATION TEST 65 M x 0 (P.D. =10 %)					
				CUMULATIVE	
PRODUCT	WT %	ASH %	F.S.I.	WT %	ASH %
STAGE I	55.7	6.6	8 1/2	55.7	3.6
STAGE II	13.5	11.0	8 1/2	69.2	7.5
TAILS	30.8	28.5	4	100.0	13.9

FROTH FLOAT PARAMETERS:

Reagent = 4:1 Kerosene:M.I.B.C.

Dosage = 0.48 lb/TDS

Conditioning Time = 1 minute

Stage I = 1st minute froth

Stage II = 2nd minute froth

Birtley Coal & Minerals Testing

A DIVISION OF GREAT WEST STEEL INDUSTRIES LTD

CLIENT: DEPARTMENT OF SUPPLY & SERVICES

SAMPLE: D.S.S. 23 Bulk Sample- FORDING COAL SAMPLE

LAB NO: 4549

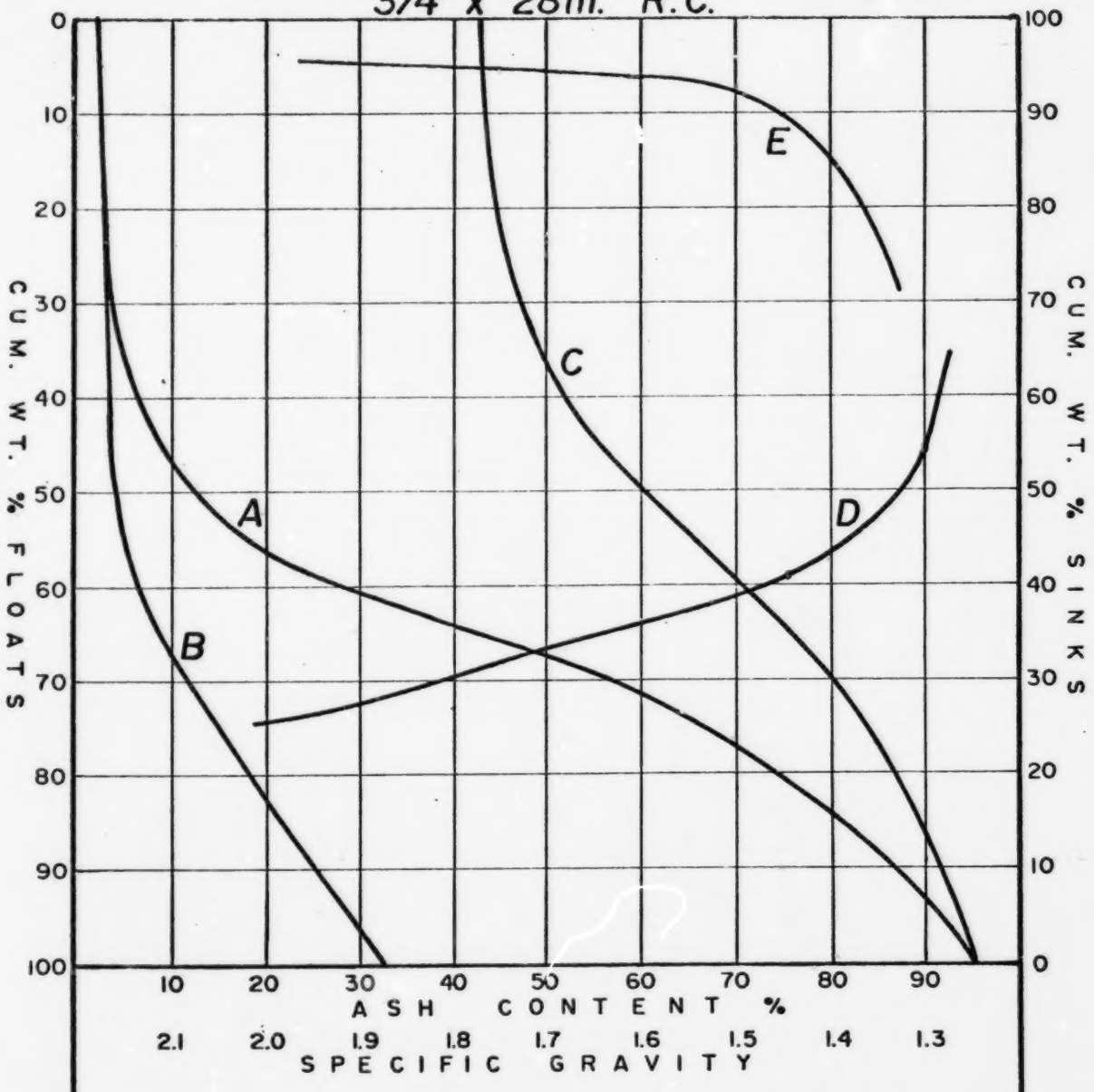
FEB./80

WASHABILITY DATA: 3/4" x 28M RAW COAL FROM SINK FLOAT ANALYSIS

SPECIFIC GRAVITY FRACTION	DIRECT		% WT. of Ash of Total	Cum. Wt.of Ash %	CUMULATIVE FLOATS		SINK WT.of ASH%	CUMULATIVE SINKS		+0.1 S.G. DISTRIBUTION	
	WT%	ASH%			WT%	ASH%		WT %	ASH%	S.G.	WT%
-1.30	45.2	3.3	1.5	1.5	45.2	3.3	30.6	54.8	55.8		
1.30 -1.35	7.6	11.1	0.8	2.3	52.8	4.4	29.8	47.2	63.1		
1.35 -1.40	3.4	16.3	0.6	2.9	56.2	5.1	29.2	43.8	66.7	1.40	15.3
1.40 -1.45	2.4	21.2	0.5	3.4	58.6	5.8	28.7	41.4	69.3	1.45	
1.45 -1.50	1.9	27.4	0.5	3.9	60.5	6.5	28.2	39.5	71.4	1.50	7.3
1.50 -1.60	3.0	35.3	1.1	5.0	63.5	7.8	27.1	36.5	74.2	1.60	6.3
1.60 -1.70	3.3	43.4	1.4	6.4	66.8	9.6	25.7	33.2	77.4	1.70	5.9
1.70 -1.80	2.6	51.3	1.3	7.7	69.4	11.2	24.4	30.6	79.7	1.80	
1.80 -2.00	4.8	60.6	2.9	10.6	74.2	14.4	21.5	25.8	83.1	1.90	4.8
+2.00	25.8	83.1	21.5	32.1	100.0	32.1					

WASHABILITY CURVES

3/4" x 28m. R.C.



A – PRIMARY CURVE
B – CLEAN COAL CURVE
C – DISCARD CURVE
D — S.G. – YIELD CURVE
E — + 0.1 S.G. DISTRIBUTION CURVE

BIRTLEY COAL and MINERALS TESTING
calgary alberta

CLIENT: DEPARTMENT OF SUPPLY AND SERVICES

SAMPLE: D.S.S. 23 BULK SAMPLE – FORDING COAL

LAB NO: 4549	DRAWN BY: M.	DATE: FEB. 1980

CLIENT: DEPARTMENT OF SUPPLY & SERVICES

SAMPLE: D.S.S. 23 Bulk Sample -FORDING COAL SAMPLE

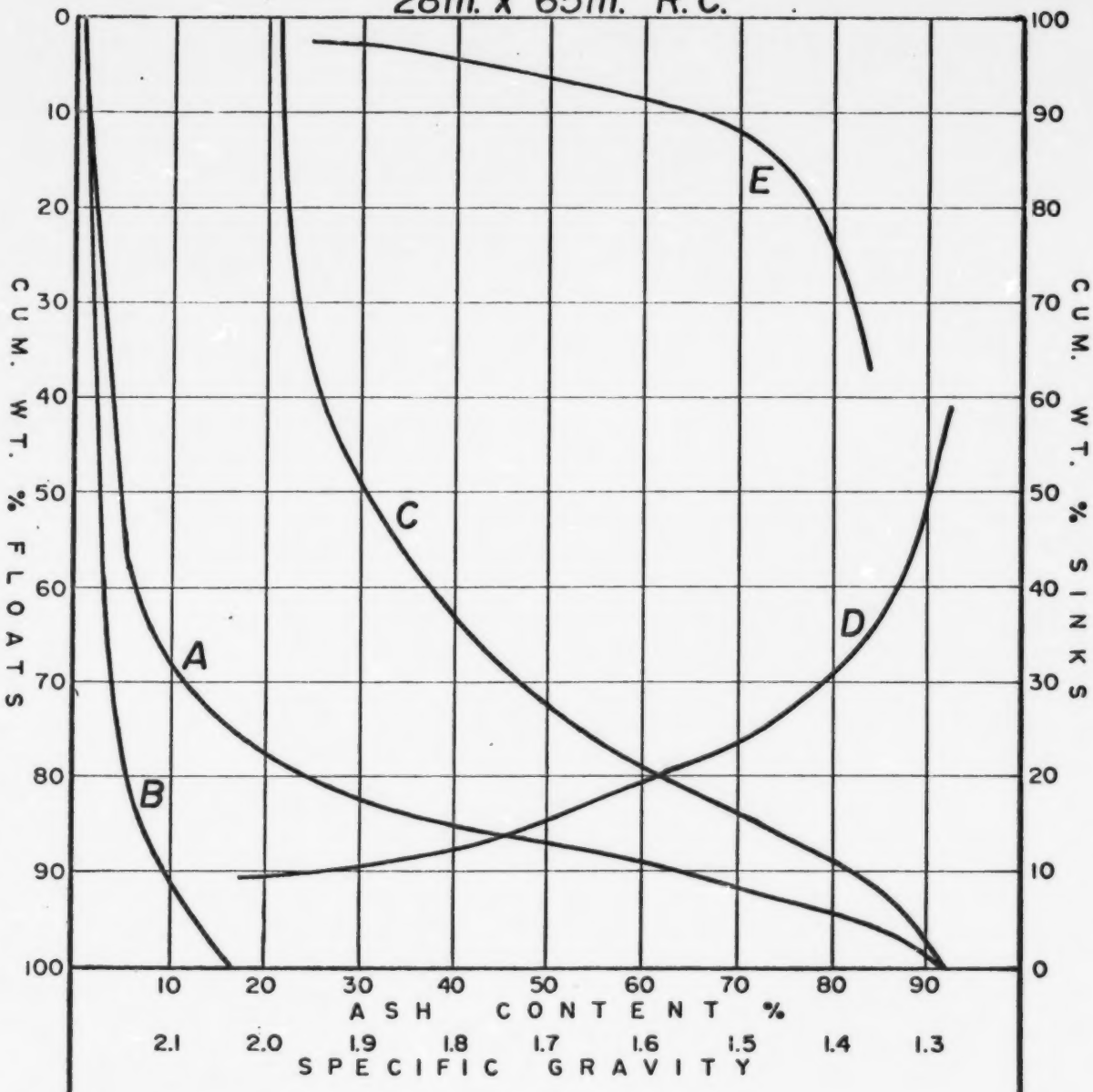
LAB NO: 4549

WASHABILITY DATA: 28M x 65M RAW COAL FROM SINK FLOAT ANALYSIS

SPECIFIC GRAVITY FRACTION	DIRECT		% WT. of Ash of Total	Cum. Wt.of Ash %	CUMULATIVE FLOATS		SINK WT.of ASH%	CUMULATIVE SINKS		+0.1 S.G. DISTRIBUTION	
	WT%	ASH%			WT%	ASH%		WT %	ASH%	S.G.	WT%
-1.30	52.1	2.4	1.2	1.2	52.1	2.4	15.3	47.9	31.9		
1.30 -1.35	12.3	5.6	0.7	1.9	64.4	3.0	14.6	35.6	41.0		
1.35 -1.40	4.5	9.9	0.4	2.3	68.9	3.5	14.2	31.1	45.7	1.40	24.0
1.40 -1.45	4.2	12.3	0.5	2.8	73.1	4.0	13.7	26.9	50.9	1.45	
1.45 -1.50	3.0	16.2	0.5	3.3	76.1	4.5	13.2	23.9	55.2	1.50	11.0
1.50 -1.60	3.8	22.7	0.9	4.2	79.9	5.3	12.3	20.1	61.1	1.60	9.4
1.60 -1.70	5.6	30.1	1.7	5.9	85.5	6.9	10.6	14.5	73.1	1.70	7.6
1.70 -1.80	2.0	49.2	1.0	6.9	87.5	7.9	9.6	12.5	76.8	1.80	
1.80 -2.00	2.8	59.4	1.7	8.6	90.3	9.5	7.9	9.7	82.0	1.90	2.8
+2.00	9.7	82.0	7.9	16.5	100.0	16.5					

WASHABILITY CURVES

28m. x 65m. R.C.



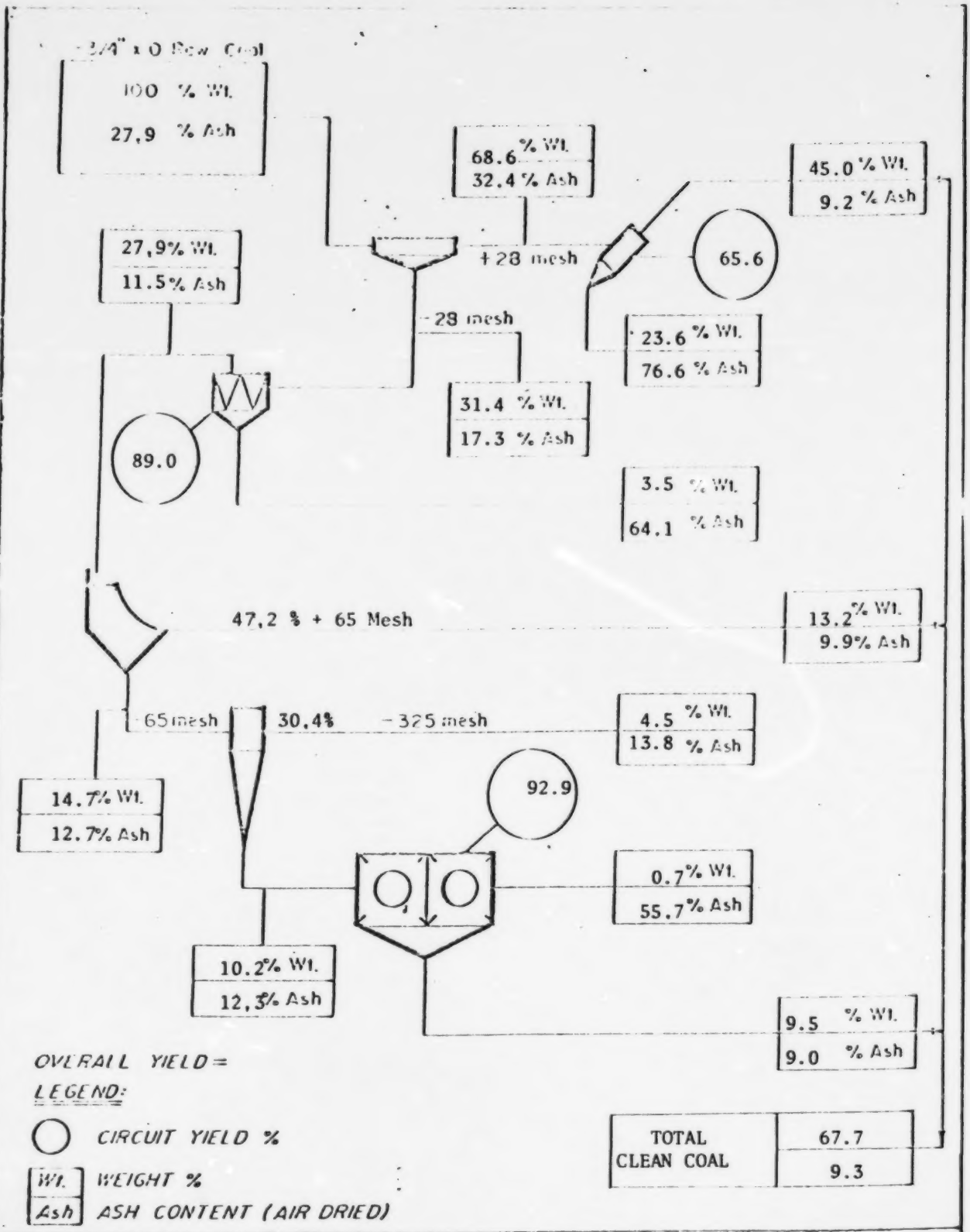
A – PRIMARY CURVE
B – CLEAN COAL CURVE
C – DISCARD CURVE
D — S.G. – YIELD CURVE
E — + 0.1 S.G. DISTRIBUTION CURVE

BIRTLEY COAL and MINERALS TESTING
calgary alberta

CLIENT: DEPARTMENT OF SUPPLY AND SERVICES

SAMPLE: D.S.S 23 BULK SAMPLE – FORDING COAL

LAB NO: 4549	DRAWN BY: A.	DATE: FEB. 1980



BIRTLEY COAL & MINERALS TESTING

Title	PILOT PLANT BALANCE FLOW SHEET Department of Supply & Services D.S.S. 23 BULK SAMPLE- FORDING COAL HIGH -ASH PRODUCT LAB NO. 4552	Date FEB.,1980 Drawn

SUMMARY - BULK WASHING DATA *

HIGH - ASH PRODUCT

Bulk Sample D.S.S. 23- FORDING COAL Lab. No. 4552

Date Received February 11, 1980 Date Washed February 25, 1980

(a) RAW COAL

Delivered Weight 15.514 MT Washed Weight 4.472 MT

ADM % 9.7 ASH% 27.9 F.S.I. 7

(b) HEAVY MEDIA CIRCUIT: 3/4" x 28 Mesh= 68.6 % by weight

S.G. of Medium 1.45 Calculated Yield 65.6 %

Sample	ASH %	F.S.I.
Feed	32.4	6 1/2
Clean Coal	9.2	8
Reject	17.3	1/2

(c) WATER -ONLY CYCLONE CIRCUIT :28M x0 = 31.4 % by weight

V.F.C. #1 6.35 cm. #2 5.08 cm. Calculated Yield 89.0 %

Sample	ASH %	F.S.I.
Feed	17.3	8
Overflow	11.5	8 1/2
Underflow	64.1	1
S.B.O.	9.9	9
S.B.U.	12.7	8 1/2

(d) FROTH FLOTATION CIRCUIT: 65M x0 14.7 %by Weight

4:1 =Kerosene: M.I.B.C. Calculated Yield 92.9 %

Sample	ASH %	F.S.I.
T.C.O.	13.8	7
Feed (T.C.U.)	12.3	8 1/2
Concentrate	9.0	8 1/2
Tailings	55.7	2

(e) FILTER CAKE : S.B.O. + CONCENTRATE = 9.7 ASH % 8 1/2 FSI

*All weights and analyses are on an Air Dried Basis unless otherwise indicated

Birtley Coal & Minerals Testing

A DIVISION OF GREAT WESTERN COAL INDUSTRIES LTD

SUMMARY - BULK WASHING DATA (Cont.)

HIGH - ASH PRODUCT

BULK SAMPLE D.S.S. 23 - FORDING COAL LAB NO. 4552

(f) CLEAN COAL: H.M.C.C. + FILTER CAKE Calculated Yield 67.7 %

	PROXIMATE								
ADM	RM%	ASH%	VM %	FC %	S	BTU	FSI	P	
11.5	0.4	9.4	30.4	59.8			8 1/2		

CLEAN COAL INVENTORY

	SHIPPED		IN STOCK	
DATE	BBLS	M.T.	BBLS	M.T.
February 29,1980			17	2.955
March 10, 1980	16		1	

BULK WASHING DATA
HIGH - ASH PRODUCT

BULK SAMPLE D.S.S. 23 - FORDING COAL LAB NO. 4552

HEAVY MEDIUM CIRCUIT

CYCLONE: 14" DSM operating @ 51.7 KPa.

MAGNETITE MEDIUM maintained @ 1.45 S.G.

1.	FEED(3/4 x 28 Mesh)	3.068	M.T.	32.4	ASH%	6 1/2	FSI
2.	CLEAN COAL	1.997	M.T.	9.2	ASH%	8	FSI
3.	REJECT	1.071	M.T.	76.6	ASH%	1/2	FSI

4. YIELD CLEAN COAL (Weighted) = $\frac{1.997}{3.068}$ = 65.1 %

5. YIELD CLEAN COAL (Calculated)= $\frac{76.6 - 32.4}{76.6 - 9.2}$ = 65.6 %

BULK WASHING DATA
HIGH - ASH PRODUCT

Bulk Sample D.S.S. 23 - FORDING COAL LAB NO. 4552

WATER - ONLY CYCLONE CIRCUIT

Primary Cyclone: 6" DSM operating @ 137.9 KPa

Vortex Finder Clearance set @ 6.35 c.m.

Secondary Cyclone: 4" DSM operating@ 34.5 KPa

Vortex Finder Clearance set @ 5.08 c.m.

Sieve Bend : 65 Mesh

1.	Feed (28 Mesh x 0)	17.3	ASH %	8	FSI	
2.	Primary Cyclone Overflow	11.5	ASH %	8 1/2	FSI	
3.	Secondary Cyclone Underflow	64.1	ASH %	1	FSI	
4.	Sieve Bend Overflow(S.B.O.)	9.9	ASH %	9	FSI	
5.	Sieve Bend Underflow(S.B.U.)	12.7	ASH %	8 1/2	FSI	
6.	Yield (W.O. Cyclone)	$\frac{64.1 - 17.3}{64.1 - 11.5}$ =		89.0	%	
7.	WT% 28Mx65M in Primary Cyclone Overflow =			47.2	%	
8.	Estimated Yield of 28M x65M (S.B.O. , as % of 28 M x 0 Feed) =			42.0	%	

Birtley Coal
& Minerals Testing

BULK WASHING DATA
HIGH - ASH PRODUCT

BULK SAMPLE D.SS. 23 - FORDING COAL LAB NO. 4552

FROTH FLOTATION CIRCUIT

Flotation Cell: two(2) Birtley -Humboldt Multi-Wobble impellers in series.

Reagent : 4:1 = Kerosene:M.I.B.C.

Thickening Cyclone : 20^{o} - 8" cyclone Hayl-Patterson

1. Thickening Cyclone Overflow (T.C.O. -325M) 13.8 ASH% 7 FSI

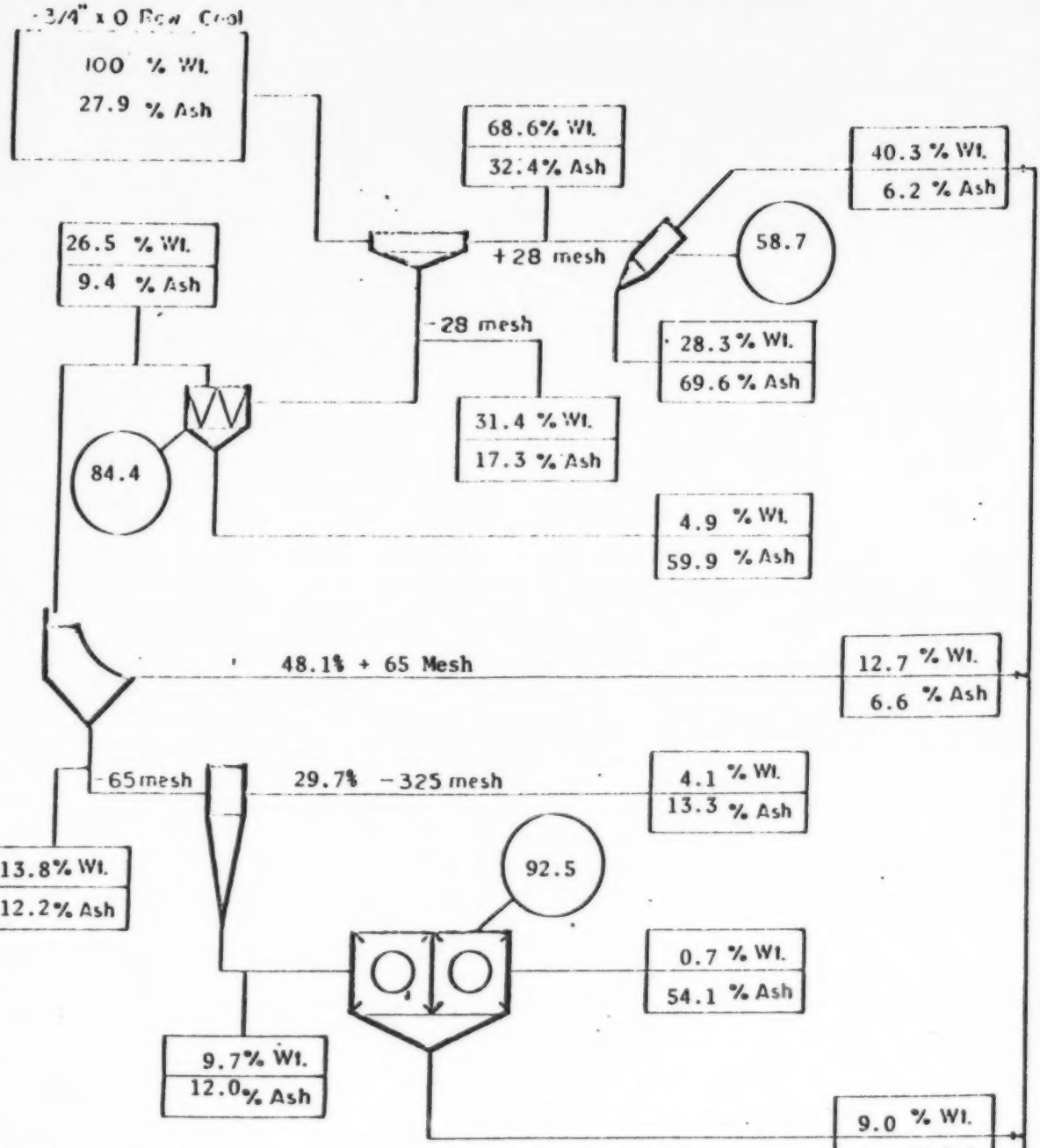
2. Flotation Feed(Thickening Cyclone Underflow) 12.3 ASH% 8 1/2FSI

3. Concentrate 9.0 ASH% 8 1/2FSI

4. Tailings 55.7 ASH% 2 FSI

5. Yield Concentrate $\frac{55.7 - 12.3}{55.7 - 9.0}$ = 92.9 %

Birtley Coal
& Minerals Testing



OVERALL YIELD =

LEGEND:

○ *CIRCUIT YIELD %*

Wt. *WEIGHT %*

Ash *ASH CONTENT (AIR DRIED)*

TOTAL CLEAN COAL	62.0
	6.6

BIRTLEY COAL & MINERALS TESTING

Title: PILOT PLANT BALANCE FLOW SHEET
DEPT. OF SUPPLY & SERVICES
D.S.S. 23 BULK SAMPLE - FORDING COAL
MEDIUM ASH PRODUCT
LAB NO. 4551

Date: FEB./80

Drawn:

SUMMARY - BULK WASHING DATA *
MEDIUM - ASH PRODUCT

Bulk Sample D.S.S. 23 - FORDING COAL Lab. No. 4551

Date Received February 11,1980 Date Washed February 21, 1980

(a) RAW COAL

Delivered Weight 15.514 MT Washed Weight 5.153 MT

ADM % 9.7 ASH% 27.9 F.S.I. 7

(b) HEAVY MEDIA CIRCUIT: 3/4" x 28 Mesh= 68.6 % by weight

S.G. of Medium 1.30 Calculated Yield 58.7%

Sample	ASH %	F.S.I.
Feed	32.4	6 1/2
Clean Coal	6.2	8 1/2
Reject	69.6	1

(c) WATER -ONLY CYCLONE CIRCUIT :28M x0 = 31.4 % by weight

V.F.C. #1 7.62 cm. #2 5.08 cm. Calculated Yield 84.4%

Sample	ASH %	F.S.I.
Feed	17.3	8
Overflow	9.4	8 1/2
Underflow	59.9	1
S.B.O.	6.6	9
S.B.U.	12.2	8 1/2

(d) FROTH FLOTATION CIRCUIT: 65M x0 13.8 %by Weight

4:1 =Kerosene: M.I.B.C. Calculated Yield 92.5 %

Sample	ASH %	F.S.I.
T.C.O.	13.3	7 1/2
Feed (T.C.U.)	12.0	8 1/2
Concentrate	8.6	8 1/2
Tailings	54.1	2 1/2

(e) FILTER CAKE : S.B.O. + CONCENTRATE = 7.5 ASH % 8 1/2 FSI

*All weights and analyses are on an Air Dried Basis unless otherwise indicated

Birtley Coal & Minerals Testing

SUMMARY - BULK WASHING DATA (Cont.)

MEDIUM - ASH PRODUCT

BULK SAMPLE D.S.S. 23 - FORDING COAL LAB NO. 4551

(f) CLEAN COAL: H.M.C.C. + FILTER CAKE Calculated Yield 62.0 %

	PROXIMATE								
ADM	RM%	ASH%	VM %	FC %	S	BTU	FSI	P	
7.2	0.4	6.5	31.3	61.8			8 1/2		

CLEAN COAL INVENTORY

	SHIPPED		IN STOCK	
DATE	BBLS	M.T.	BBLS	M.T.
February 28, 1980			17	3.043
March 10, 1980	16		1	

Birtley Coal
& Minerals Testing

BULK WASHING DATA
MEDIUM - ASH PRODUCT

BULK SAMPLED D.S.S. 23- FORDING COAL LAB NO. 4551

HEAVY MEDIUM CIRCUIT

CYCLONE: 14" DSM operating @ 51.7 KPa.

MAGNETITE MEDIUM maintained @ 1.30 S.G.

1.	FEED(3/4 x 28 Mesh)	3.537	M.T.	32.4	ASH%	6 1/2	FSI
2.	CLEAN COAL	2.048	M.T.	6.2	ASH%	8 1/2	FSI
3.	REJECT	1.489	M.T.	69.6	ASH%	1	FSI

4. YIELD CLEAN COAL (Weighted) = $\frac{2.048}{3.537}$ = 57.9 %

5. YIELD CLEAN COAL (Calculated)= $\frac{69.6-32.4}{69.6-6.2}$ = 58.7 %

Birtley Coal
& Minerals Testing

BULK WASHING DATA
MEDIUM-ASH PRODUCT

Bulk Sample D.S.S. 23- FORDING COAL LAB NO. 4551

WATER - ONLY CYCLONE CIRCUIT

Primary Cyclone: 6" DSM operating @ 137.9 KPa

Vortex Finder Clearance set @ 7.62 CM

Secondary Cyclone: 4" DSM operating@ 34.5 KPa

Vortex Finder Clearance set @ 5.08 CM

Sieve Bend : 65 Mesh

1.	Feed (28 Mesh x 0)	17.3	ASH %	8	FSI
2.	Primary Cyclone Overflow	9.4	ASH %	8 1/2	FSI
3.	Secondary Cyclone Underflow	59.9	ASH %	1	FSI
4.	Sieve Bend Overflow(S.B.O.)	6.6	ASH %	9	FSI
5.	Sieve Bend Underflow(S.B.U.)	12.2	ASH %	8 1/2	FSI
6.	Yield (W.O. Cyclone)	$\frac{59.9-17.3}{59.9-9.4}$ =	84.4	%	
7.	WT% 28Mx65M in Primary Cyclone Overflow	=	48.1	%	
8.	Estimated Yield of 28M x65M (S.B.O. , as % of 28 M x 0 Feed)	=	40.6	%	

Birtley Coal
& Minerals Testing

BULK WASHING DATA
MEDIUM - ASH PRODUCT

BULK SAMPLE D.S.S. 23 - FORDING COAL LAB NO. 4551

FROTH FLOTATION CIRCUIT

Flotation Cell: two(2) Birtley -Humboldt Multi-Wobble impellers in series.

Reagent : 4:1 = Kerosene:M.I.B.C.

Thickening Cyclone : 20° - 8" cyclone Hayl-Patterson

1. Thickening Cyclone Overflow (T.C.O. -325M) 13.3 ASH% 7 1/2 FSI

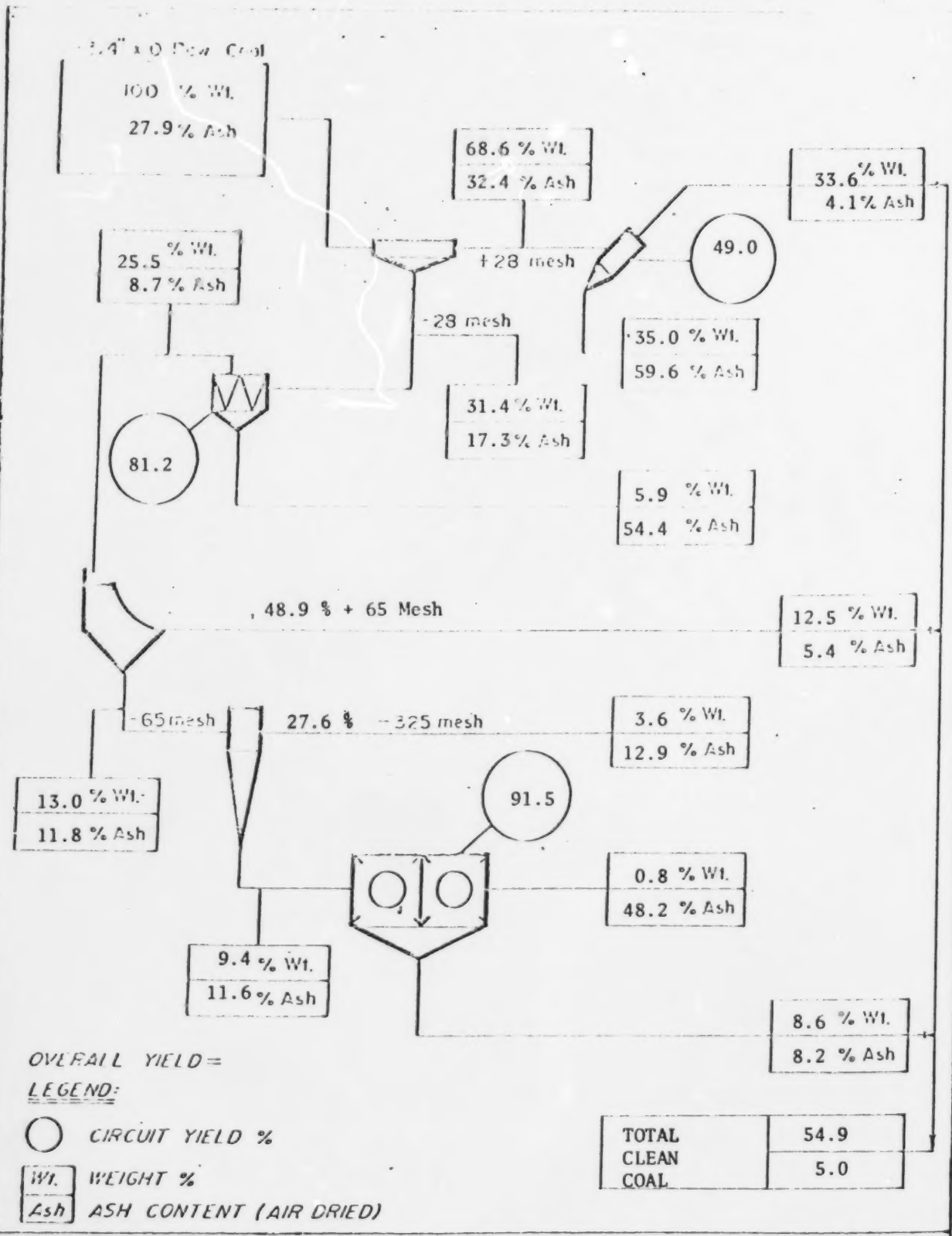
2. Flotation Feed(Thickening Cyclone Underflow) 12.0 ASH% 8 1/2 FSI

3. Concentrate 8.6 ASH% 8 1/2 FSI

4. Tailings 54.1 ASH% 2 1/2 FSI

5. Yield Concentrate $\frac{54.1 - 12.0}{54.1 - 8.6} = 92.5\ \%$

Birtley Coal
& Minerals Testing



BIRTLEY COAL & MINERALS TESTING

Title	PILOT PLANT BALANCE FLOW SHEET DEPARTMENT OF SUPPLY & SERVICES D.S.S 23 BULK SAMPLE - FORDING COAL LOW - ASH PRODUCT LAB NO. 4550	Date FEB. ,1980 Drawn

SUMMARY - BULK WASHING DATA *
LOW - ASH PRODUCT

Bulk Sample D.S.S. 23 - FORDING COAL Lab. No. 4550

Date Received February 11, 1980 Date Washed February 21, 1980

(a) RAW COAL

Delivered Weight 15.514 MT Washed Weight 5.484 MT

ADM % 9.7 ASH% 27.9 F.S.I. 7

(b) HEAVY MEDIA CIRCUIT: 3/4" x 28 Mesh= 68.6 % by weight

S.G. of Medium 1.22 Calculated Yield 49.0 %

Sample	ASH %	F.S.I.
Feed	32.4	6 1/2
Clean Coal	4.1	8 1/2
Reject	59.6	1

(c) WATER -ONLY CYCLONE CIRCUIT :28M x0 = 31.4 % by weight

V.F.C. #1 8.89 cm. #2 5.08 cm. Calculated Yield 81.2 %

Sample	ASH %	F.S.I.
Feed	17.3	8
Overflow	8.7	8 1/2
Underflow	54.4	1 1/2
S.B.O.	5.4	9
S.B.U.	11.8	8 1/2

(d) FROTH FLOTATION CIRCUIT: 65M x0 13.0 %by Weight

4:1 =Kerosene: M.I.B.C. Calculated Yield 91.5 %

Sample	ASH %	F.S.I.
T.C.O.	12.9	7 1/2
Feed (T.C.U.)	11.6	8 1/2
Concentrate	8.2	8 1/2
Tailings	48.2	2 1/2

(e) FILTER CAKE : S.B.O. + CONCENTRATE = 6.7 ASH % 8 1/2 FSI

*All weights and analyses are on an Air Dried Basis unless otherwise indicated

Birtley Coal & Minerals Testing

A DIVISION OF GREAT WEST STEEL INDUSTRIES LTD

SUMMARY -BULK WASHING DATA (Cont.)

LOW - ASH PRODUCT

BULK SAMPLE D.S.S. 23 - FORDING COAL LAB NO. 4550

(f) CLEAN COAL: H.M.C.C. + FILTER CAKE Calculated Yield 54.9 %

	PROXIMATE								
ADM	RM%	ASH%	VM %	FC %	S	BTU	FSI	P	
8.8	0.3	5.0	31.5	63.2			8 1/2		

CLEAN COAL INVENTORY

	SHIPPED		IN STOCK	
DATE	BBLS	M.T.	BBLS	M.T.
February 27, 1980			17	2.886
March 10, 1980	16		1	

Birtley Coal
& Minerals Testing

BULK WASHING DATA
LOW - ASH PRODUCT

BULK SAMPLE D.S.S. 23- FORDING COAL LAB NO. 4550

HEAVY MEDIUM CIRCUIT

CYCLONE: 14" DSM operating @ 51.7 KPa.

MAGNETITE MEDIUM maintained @ 1.22 S.G.

1.	FEED(3/4 x 28 Mesh)	3.762	M.T.	32.4	ASH%	6 1/2	FSI
2.	CLEAN COAL	1.845	M.T.	4.1	ASH%	8 1/2	FSI
3.	REJECT	1.917	M.T.	59.6	ASH%	1	FSI

4. YIELD CLEAN COAL (Weighted) = $\frac{1.845}{3.762}$ = 48.8 %

5. YIELD CLEAN COAL (Calculated)= $\frac{59.6 - 32.4}{59.6 - 4.1}$ = 49.0 %

Birtley Coal
& Minerals Testing

BULK WASHING DATA

LOW - ASH PRODUCT

Bulk Sample D.S.S. 23 - FORDING COAL LAB NO. 4550

WATER - ONLY CYCLONE CIRCUIT

Primary Cyclone: 6" DSM operating @ 137.9 KPa

Vortex Finder Clearance set @ 8.89 c.m.

Secondary Cyclone: 4" DSM operating@ 34.5 KPa

Vortex Finder Clearance set @ 5.08 c.m.

Sieve Bend : 65 Mesh

1.	Feed (28 Mesh x 0)	17.3	ASH %	8	FSI
2.	Primary Cyclone Overflow	8.7	ASH %	8 1/2	FSI
3.	Secondary Cyclone Underflow	54.4	ASH %	1 1/2	FSI
4.	Sieve Bend Overflow(S.B.O.)	5.4	ASH %	9	FSI
5.	Sieve Bend Underflow(S.B.U.)	11.8	ASH %	8 1/2	FSI
6.	Yield (W.O. Cyclone)	$\frac{54.4 - 17.3}{54.4 - 8.7}$		81.2	%
7.	WT% 28Mx65M in Primary Cyclone Overflow	=		48.9	%
8.	Estimated Yield of 28M x65M (S.B.O. , as % of 28 M x 0 Feed)	=		39.7	%

Birtley Coal
& Minerals Testing

A DIVISION OF GREAT WEST STEEL INDUSTRIES LTD

BULK WASHING DATA
LOW - ASH PRODUCT

BULK SAMPLE D.S.S. 23 - FORDING COAL LAB NO. 4550

FROTH FLOTATION CIRCUIT

Flotation Cell: two(2) Birtley -Humboldt Multi-Wobble impellers in series.

Reagent : 4:1 = Kerosene:M.I.B.C.

Thickening Cyclone : 20° - 8" cyclone Hayl-Patterson

1. Thickening Cyclone Overflow (T.C.O. -325M) 12.9 ASH% 7 1/2 FSI

2. Flotation Feed(Thickening Cyclone Underflow) 11.6 ASH% 8 1/2 FSI

3. Concentrate 8.2 ASH% 8 1/2 FSI

4. Tailings 48.2 ASH% 2 1/2 FSI

5. Yield Concentrate $\frac{48.2 - 11.6}{48.2 - 8.2}$ = 91.5 %

Birtley Coal
& Minerals Testing

PART 5

CARDINAL RIVER COAL

CLIENT; DEPT, OF SUPPLY & SERVICES, CANADA March 12, 1980

PROJECT:D.S.S. 23

SAMPLE :CARDINAL RIVER

LAB NO.:4635

SIZE AND RAW ANALYSIS , a.d.b.					
				CUMULATIVE	
SIZE FRACTION	WT %	ASH %	F.S.I.	WT %	ASH %
3/4" x 28 M	74.4	14.5	4	74.4	14.5
28 M x 65 M	14.1	12.2	6	88.5	14.1
65 M x 0	11.5	14.6	4	100.0	14.2
HEAD RAW	100.0	14.2	4		
WT % + 3/4"	20.4 % crushed to pass 3/4"				

SINK - FLOAT ANALYSIS ,a.d.b.										
	3/4" x 28 M					28 M x 65 M				
				CUMULATIVE					CUMULATIVE	
S.G. FRACTION	WT %	ASH%	F.S.I.	WT %	ASH%	WT%	ASH %	F.S.I.	WT %	ASH %
-1.30	20.3	2.8	9	20.3	2.8	25.5	2.7	9	25.5	2.7
1.30-1.35	26.8	6.4	5 1/2	47.1	4.8	28.2	5.4	8	53.7	4.1
1.35-1.40	18.2	11.0	1 1/2	65.3	6.6	19.0	9.1	1 1/2	72.7	5.4
1.40-1.45	9.6	16.3	1	74.9	7.8	8.1	13.4	1	80.8	6.2
1.45-1.50	6.7	21.3	1	81.6	8.9	6.3	19.1	1	87.1	7.2
1.50-1.60	9.1	27.5	1	90.7	10.8	5.1	26.2	1	92.2	8.2
1.60-1.70	3.9	35.1	1	94.6	11.8	3.1	35.0	1	95.3	9.1
1.70-1.80	1.6	40.7	1/2	96.2	12.3	1.3	45.4	1/2	96.6	9.6
1.80-2.00	1.4	45.8	1/2	97.6	12.7	0.9	54.3	1/2	97.5	10.0
+2.00	2.4	83.2	0	100.0	14.4	2.5	80.4	0	100.0	11.7

Birtley Coal
& Minerals Testing

CLIENT : DEPT. OF SUPPLY & SERVICES, CANADA

PROJECT: D.S.S. 23 MAR. 12,1980

SAMPLE : CARDINAL RIVER

LAB NO.: 4635

FROTH FLOTATION TEST					
65 M x 0 (P.D. =10%)					
				CUMULATIVE	
PRODUCT	WT %	ASH%	F.S.I.	WT %	ASH %
STAGE 1	60.2	9.2	6 1/2	60.2	9.2
STAGE 11	16.9	14.3	2 1/2	77.1	10.3
TAILS	22.9	29.1	1	100.0	14.6

FROTH FLOAT PARAMETERS:

Reagent	4:1 = Kerosene : MIBC
Dosage	0.48 lb./T.D.S.
Conditioning Time	1 minute
Stage 1	1st minute froth
Stage 11	2nd minute froth

Birtley Coal
& Minerals Testing

A DIVISION OF GREAT WEST STEEL INDUSTRIES LTD

CLIENT: DEPARTMENT OF SUPPLY & SERVICES

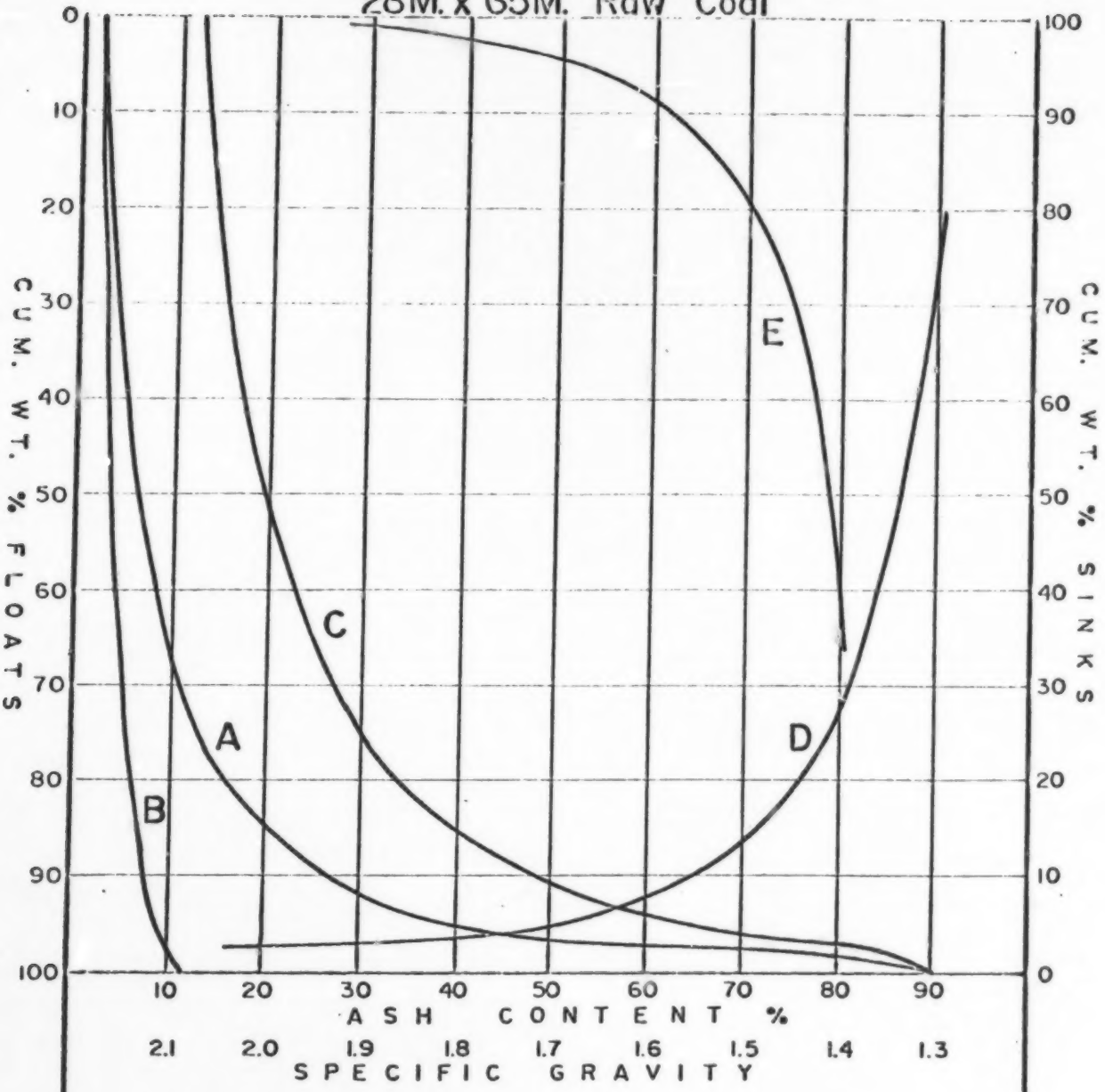
SAMPLE: D.S.S. 23 BULK SAMPLE - CARDINAL RIVER COAL

LAB NO: 4635

WASHABILITY DATA: 28M x 65M RAW COAL FROM SINK FLOAT ANALYSIS

SPECIFIC GRAVITY FRACTION	DIRECT		% WT. of Ash of Total	Cum. Wt.of Ash %	CUMULATIVE FLOATS		SINK WT.of ASH%	CUMULATIVE SINKS		+0.1 S.G. DISTRIBUTION	
	WT%	ASH%			WT%	ASH%		WT %	ASH%	S.G.	WT%
-1.30	25.5	2.7	0.7	0.7	25.5	2.7	11.0	74.5	14.8		
1.30 -1.35	28.2	5.4	1.5	2.2	53.7	4.1	9.5	46.3	20.5		
1.35 -1.40	19.0	9.1	1.7	3.9	72.7	5.4	7.8	27.3	28.6	1.40	61.6
1.40 -1.45	8.1	13.4	1.1	5.0	80.8	6.2	6.7	19.2	34.9	1.45	35.3
1.45 -1.50	6.3	19.1	1.2	6.2	87.1	7.2	5.5	12.9	42.6	1.50	19.5
1.50 -1.60	5.1	26.2	1.3	7.5	92.2	8.2	4.2	7.8	53.8	1.60	8.2
1.60 -1.70	3.1	35.0	1.1	8.6	95.3	9.1	3.1	4.7	66.0	1.70	4.4
1.70 -1.80	1.3	45.4	0.6	9.2	96.6	9.6	2.5	3.4	73.5	1.80	2.1
1.80 -2.00	0.9	54.3	0.5	9.7	97.5	10.0	2.0	2.5	80.4	1.90	0.9
+2.00	2.5	80.4	2.0	11.7	100.0	11.7					

WASHABILITY CURVES
28M. x 65M. Raw Coal



A – PRIMARY CURVE
B – CLEAN COAL CURVE
C – DISCARD CURVE
D — S.G. – YIELD CURVE
E — + 0.1 S.G. DISTRIBUTION CURVE

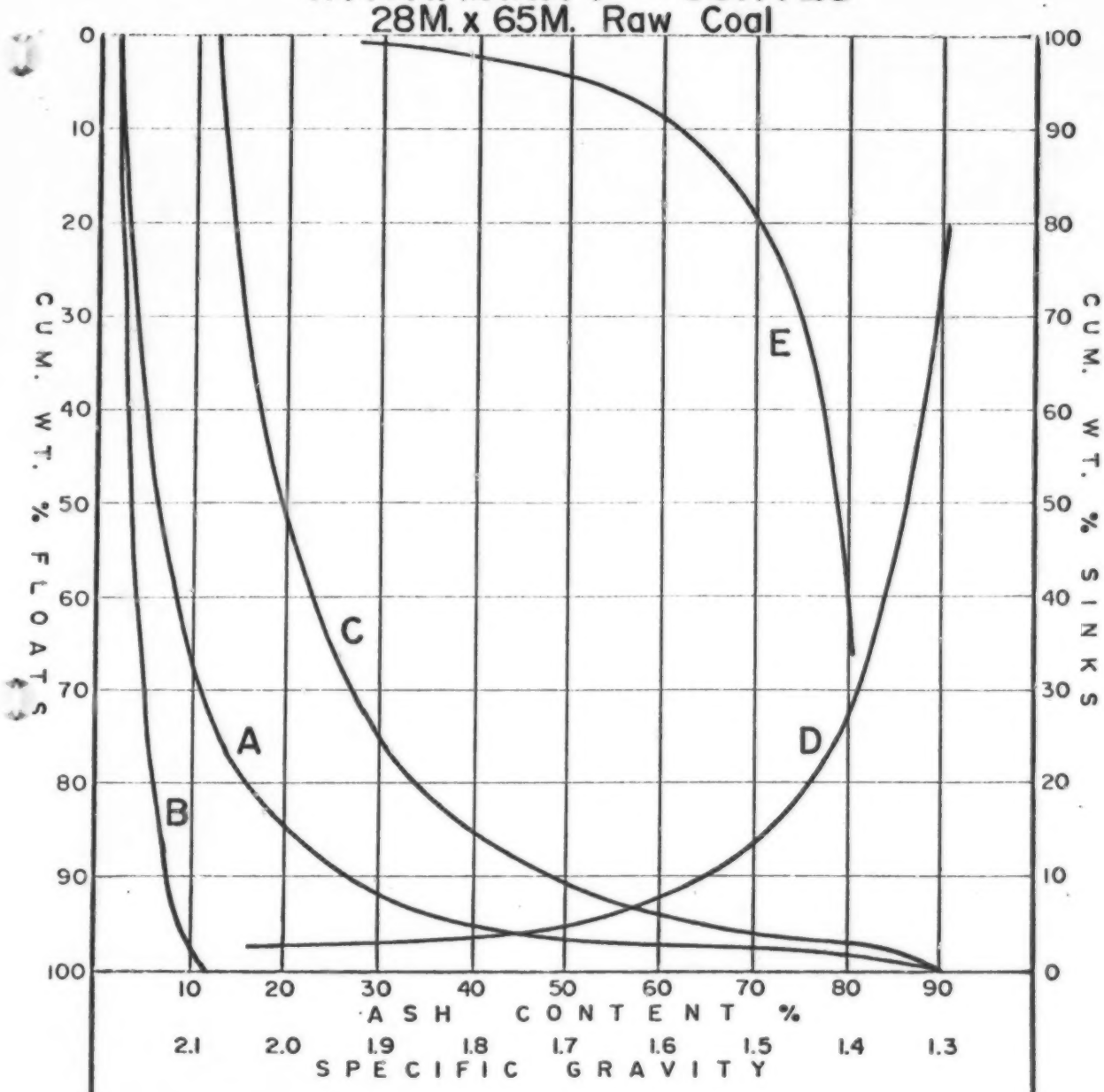
BIRTLEY COAL and MINERALS TESTING
calgary alberta

CLIENT: *DEPARTMENT OF SUPPLY AND SERVICES*

SAMPLE: *D.S.S. 23 BULK SAMPLE – CARDINAL RIVER COAL*

LAB NO: 4635	DRAWN BY: A.	DATE: *MARCH, 1980*

WASHABILITY CURVES
28M. x 65M. Raw Coal



A – PRIMARY CURVE
B – CLEAN COAL CURVE
C – DISCARD CURVE
D — S.G. – YIELD CURVE
E — + 0.1 S.G. DISTRIBUTION CURVE

BIRTLEY COAL and MINERALS TESTING
calgary alberta

CLIENT: DEPARTMENT OF SUPPLY AND SERVICES

SAMPLE: D.S.S. 23 BULK SAMPLE – CARDINAL RIVER COAL

LAB NO: 4635	DRAWN BY: A.	DATE: MARCH, 1980

CLIENT: DEPARTMENT OF SUPPLY & SERVICES

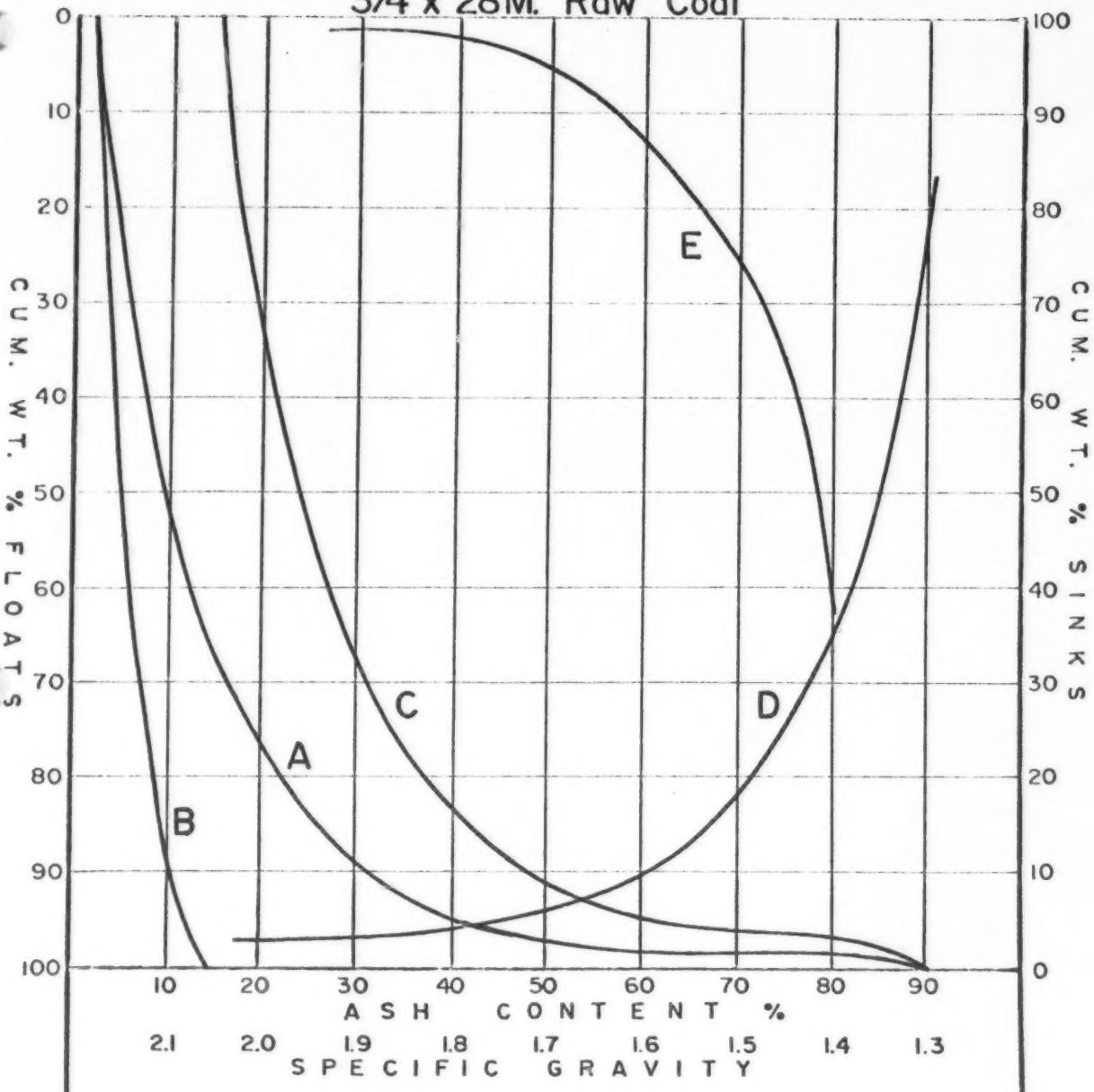
SAMPLE: D.S.S. 23 BULK SAMPLE - CARDINAL RIVER COAL

LAB NO: 4635

WASHABILITY DATA: 3/4" x 28M RAW COAL FROM SINK FLOAT ANALYSIS

SPECIFIC GRAVITY FRACTION	DIRECT		% WT. of Ash of Total	Cum. Wt.of Ash %	CUMULATIVE FLOATS		SINK WT.of ASH%	CUMULATIVE SINKS		+0.1 S.G. DISTRIBUTION	
	WT%	ASH%			WT%	ASH%		WT %	ASH%	S.G.	WT%
-1.30	20.3	2.8	0.6	0.6	20.3	2.8	13.8	79.7	17.3		
1.30 -1.35	26.8	6.4	1.7	2.3	47.1	4.8	12.1	52.9	22.9		
1.35 -1.40	18.2	11.0	2.0	4.3	65.3	6.6	10.1	34.7	29.1	1.40	61.3
1.40 -1.45	9.6	16.3	1.6	5.9	74.9	7.8	8.5	25.1	33.9	1.45	36.2
1.45 -1.50	6.7	21.3	1.4	7.3	81.6	8.9	7.1	18.4	38.6	1.50	25.4
1.50 -1.60	9.1	27.5	2.5	9.8	90.7	10.8	4.6	9.3	49.5	1.60	13.0
1.60 -1.70	3.9	35.1	1.4	11.2	94.6	11.8	3.2	5.4	59.3	1.70	5.5
1.70 -1.80	1.6	40.7	0.6	11.8	96.2	12.3	2.6	3.8	68.4	1.80	2.3
1.80 -2.00	1.4	45.8	0.6	12.4	97.6	12.7	2.0	2.4	83.2	1.90	1.4
+2.00	2.4	83.2	2.0	14.4	100.0	14.4					

WASHABILITY CURVES
3/4" x 28M. Raw Coal



A – PRIMARY CURVE
B – CLEAN COAL CURVE
C – DISCARD CURVE
D — S.G. – YIELD CURVE
E — + 0.1 S.G. DISTRIBUTION CURVE

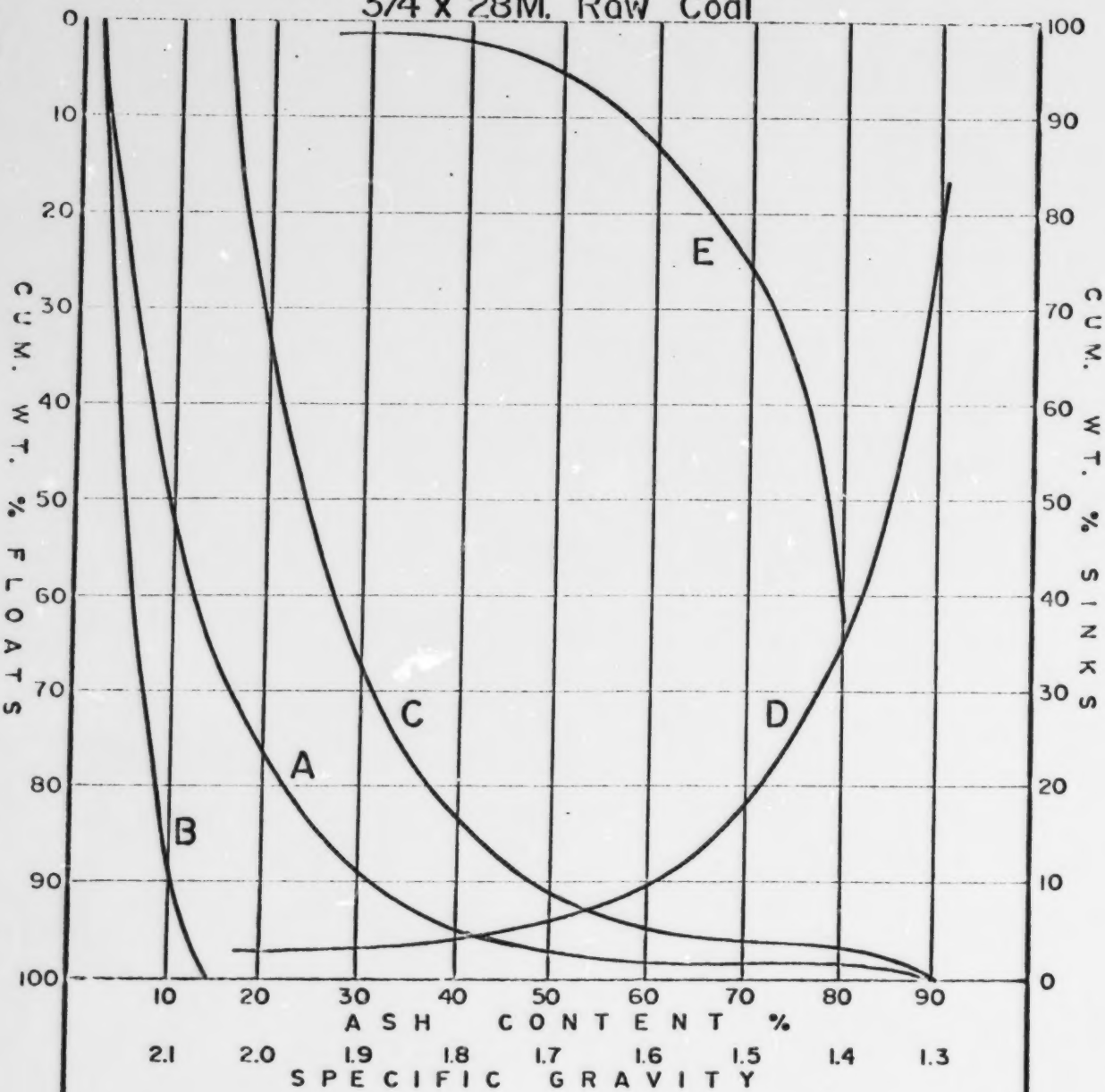
BIRTLEY COAL and MINERALS TESTING
calgary alberta

CLIENT: *DEPARTMENT OF SUPPLY AND SERVICES*

SAMPLE: *D.S.S. 23 BULK SAMPLE – CARDINAL RIVER COAL*

LAB NO: 4635	DRAWN BY: A.	DATE: MARCH, 1980

WASHABILITY CURVES
3/4" x 28M. Raw Coal



A – PRIMARY CURVE
B – CLEAN COAL CURVE
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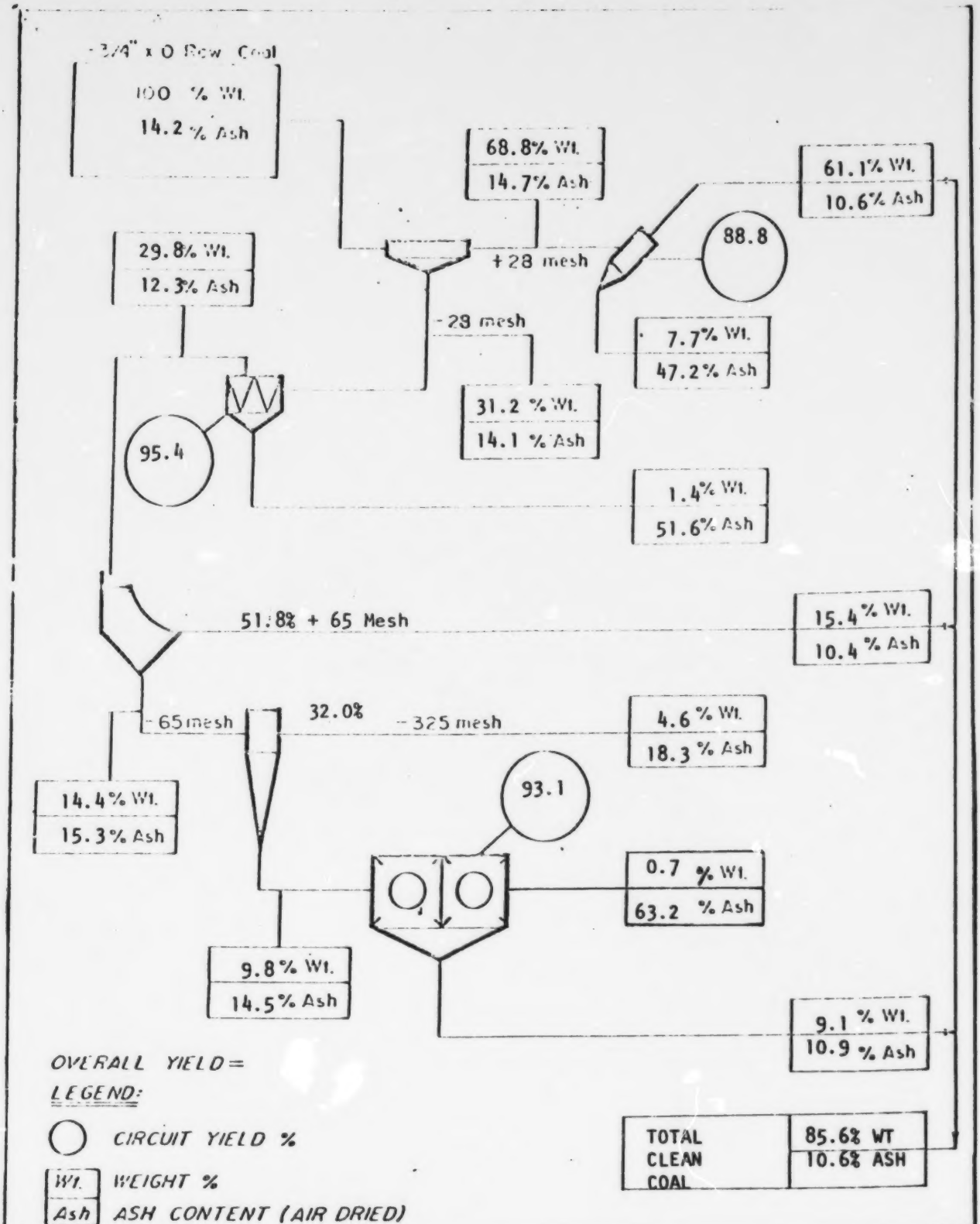
BIRTLEY COAL and MINERALS TESTING
calgary alberta

CLIENT: DEPARTMENT OF SUPPLY AND SERVICES

SAMPLE: D.S.S. 23 BULK SAMPLE – CARDINAL RIVER COAL

LAB NO: 4635	DRAWN BY: JA	DATE: MARCH, 1980



BIRTLEY COAL & MINERALS TESTING

Title	PLANT BALANCE FLOW SHEET DEPARTMENT OF SUPPLY AND SERVICES D.S.S. 23 BULK SAMPLE - CARDINAL RIVER COAL HIGH - ASH PRODUCT	Date March , 1980
		Drawn

SUMMARY - BULK WASHING DATA *

HIGH - ASH PRODUCT

Bulk Sample D.S.S. 23- CARDINAL RIVER COAL Lab. No. 4638

Date Received March 7, 1980 Date Washed March 17, 1980

(a) RAW COAL

Delivered Weight 10.808 MT Washed Weight 2.955 MT

ADM % 3.9 ASH% 14.2 F.S.I. 4

(b) HEAVY MEDIA CIRCUIT: 3/4" x 28 Mesh= 68.8 % by weight

S.G. of Medium 1.37 Calculated Yield 88.8 %

Sample	ASH %	F.S.I.
Feed	14.7	4
Clean Coal	10.6	6
Reject	47.2	1/2

(c) WATER -ONLY CYCLONE CIRCUIT :28M x0 = 31.2 % by weight

V.F.C. #1 5.08 cm. #2 5.08 cm. Calculated Yield 95.4%

Sample	ASH %	F.S.I.
Feed	14.1	4 1/2
Overflow	12.3	5 1/2
Underflow	51.6	1/2
S.B.O.	10.4	6 1/2
S.B.U.	15.3	3

(d) FROTH FLOTATION CIRCUIT: 65M x0 14.4 %by Weight

4:1 =Kerosene: M.I.B.C. Calculated Yield 93.1%

Sample	ASH %	F.S.I.
T.C.O.	18.3	1/2
Feed (T.C.U.)	14.5	4 1/2
Concentrate	10.9	6 1/2
Tailings	63.2	1/2

(e) FILTER CAKE : S.B.O. + CONCENTRATE = 10.6 ASH % 6 1/2 FSI

*All weights and analyses are on an Air Dried Basis unless otherwise indicated

Birtley Coal & Minerals Testing

SUMMARY - BULK WASHING DATA (Cont.)
HIGH - ASH PRODUCT

BULK SAMPLE D.S.S. 23 CARDINAL RIVER COAL LAB NO. 4638

(F) CLEAN COAL: H.M.C.C. + FILTER CAKE Calculated Yield 85.6%

ADM	PROXIMATE				S	BTU	FSI	P	
	RM%	ASH%	VM %	FC %					
5.5	0.3	10.6	19.1	70.0			6		

CLEAN COAL INVENTORY

DATE	SHIPPED		IN STOCK	
	BBLS	M.T.	BBLS	M.T.
March 20, 1980			12	2,417

Birtley Coal

BULK WASHING DATA
HIGH - ASH PRODUCT

BULK SAMPLE D.SS.23-CARDINAL RIVER COAL LAB NO. 4638

HEAVY MEDIUM CIRCUIT

CYCLONE: 14" DSM operating @ 51.7 KPa.

MAGNETITE MEDIUM maintained @ 1.37 S.G.

1.	FEED(3/4 x 28 Mesh)	2.033	M.T.	14.7	ASH%	4	FSI
2.	CLEAN COAL	1.777	M.T.	10.6	ASH%	6	FSI
3.	REJECT	0.256	M.T.	47.2	ASH%	1/2	FSI

4. YIELD CLEAN COAL (Weighted) = $\frac{1.777}{2.033}$ = 87.4 %

5. YIELD CLEAN COAL (Calculated)= $\frac{47.2 - 14.7}{47.2 - 10.6}$ = 88.8 %

Birtley Coal
& Minerals Testing

BULK WASHING DATA
HIGH - ASH PRODUCT

Bulk Sample D.S.S.23-CARDINAL RIVER COAL LAB NO. 4638

WATER - ONLY CYCLONE CIRCUIT

Primary Cyclone: 6" DSM operating @ 137.9 KPa

Vortex Finder Clearance set @ 5.08 c.m.

Secondary Cyclone: 4" DSM operating@ 34.5 KPa

Vortex Finder Clearance set @ 5.08 c.m.

Sieve Bend : 65 Mesh

1.	Feed (28 Mesh x 0)	14.1	ASH %	4 1/2	FSI
2.	Primary Cyclone Overflow	12.3	ASH %	5 1/2	FSI
3.	Secondary Cyclone Underflow	51.6	ASH %	1/2	FSI
4.	Sieve Bend Overflow(S.B.O.)	10.4	ASH %	6 1/2	FSI
5.	Sieve Bend Underflow(S.B.U.)	15.3	ASH %	3	FSI

6. Yield (W.O. Cyclone) $\frac{51.6 - 14.1}{51.6 - 12.3}$ = 95.4 %

7. WT% 28Mx65M in Primary Cyclone Overflow = 51.8 %

8. Estimated Yield of 28M x65M (S.B.O. , as % of 28 M x 0 Feed) = 49.4 %

Birtley Coal
& Minerals Testing

BULK WASHING DATA
HIGH - ASH PRODUCT

BULK SAMPLE D.S.S.23-CARDINAL RIVER COAL LAB NO. 4638

FROTH FLOTATION CIRCUIT

Flotation Cell: two(2) Birtley -Humboldt Multi-Wobble impellers in series.

Reagent : 4:1 = Kerosene:M.I.B.C.

Thickening Cyclone : 20° - 8" cyclone Hayl-Patterson

1. Thickening Cyclone Overflow (T.C.O. -325M) 18.3 ASH% 1/2 FSI

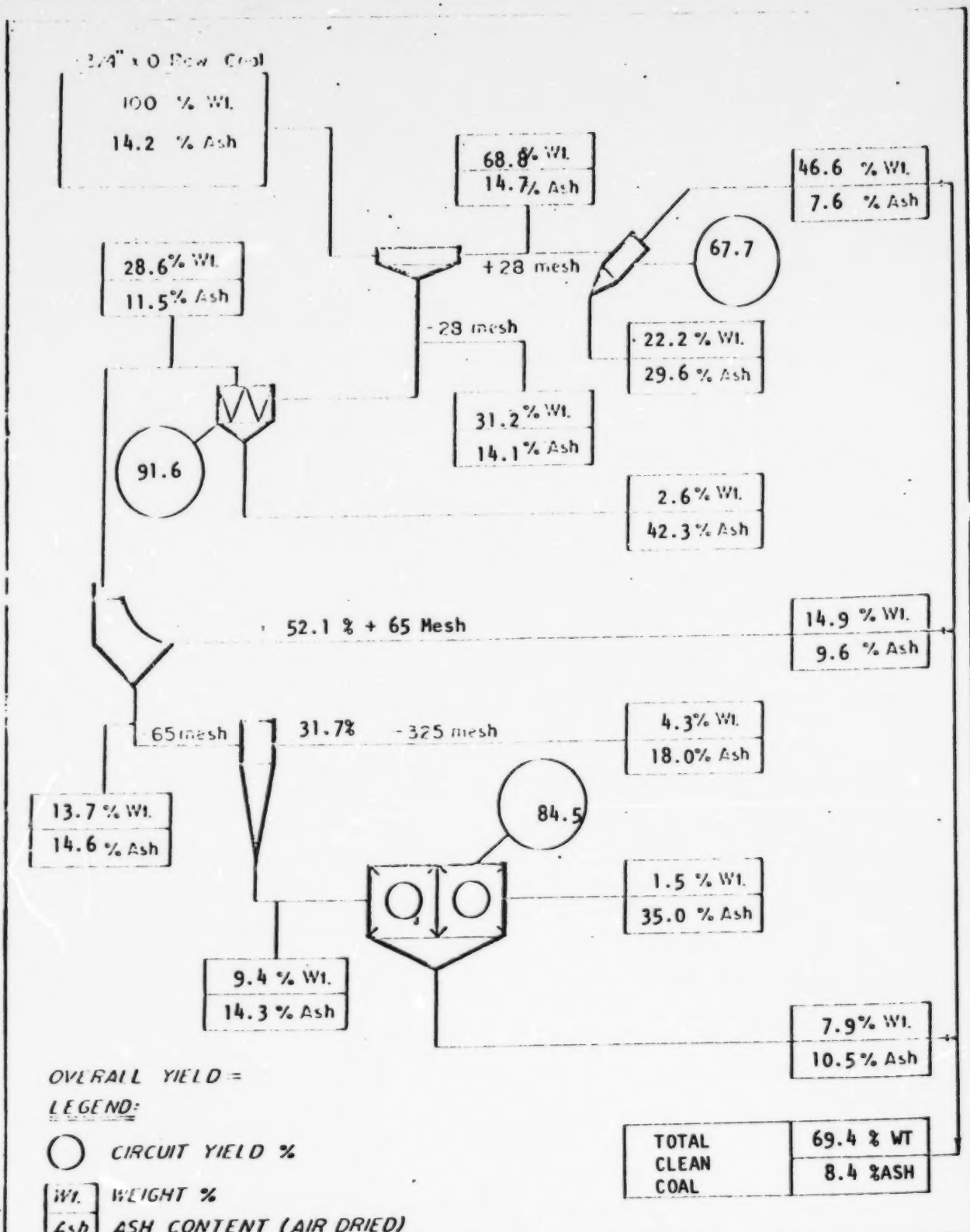
2. Flotation Feed(Thickening Cyclone Underflow) 14.5 ASH% 4 1/2 FSI

3. Concentrate 10.9 ASH% 6 1/2 FSI

4. Tailings 63.2 ASH% 1/2 FSI

5. Yield Concentrate $\frac{63.2 - 14.5}{63.2 - 10.9}$ = 93.1 %

Birtley Coal
& Minerals Testing



BIRTLEY COAL & MINERALS TESTING

Title: PLANT BALANCE FLOW SHEET DEPARTMENT OF SUPPLY AND SERVICES D.S.S. 23 -BULK SAMPLE -CARDINAL RIVER COAL MEDIUM-ASH PRODUCT LAB NO. 4636	Date: March , 1980 Drawn

SUMMARY - BULK WASHING DATA *
MEDIUM - ASH PRODUCT

Bulk Sample D.S.S. 23-CARDINAL RIVER COAL Lab. No. 4636

Date Received March 7, 1980 Date Washed March 14, 1980

(a) RAW COAL

Delivered Weight 10.808 MT Washed Weight 3.953 MT

ADM % 3.9 ASH% 14.2 F.S.I. 4

(b) HEAVY MEDIA CIRCUIT: 3/4" x 28 Mesh= 68.8 % by weight

S.G. of Medium 1.28 Calculated Yield 67.7 %

Sample	ASH %	F.S.I.
Feed	14.7	4
Clean Coal	7.6	7
Reject	29.6	1

(c) WATER -ONLY CYCLONE CIRCUIT :28M x0 = 31.2 % by weight

V.F.C. #1 6.35 cm. #2 5.08 cm. Calculated Yield 91.6%

Sample	ASH %	F.S.I.
Feed	14.1	4 1/2
Overflow	11.5	5 1/2
Underflow	42.3	1/2
S.B.O.	9.6	7
S.B.U.	14.6	3

(d) FROTH FLOTATION CIRCUIT: 65M x0 13.7 %by Weight

4:1 =Kerosene: M.I.B.C. Calculated Yield 84.5%

Sample	ASH %	F.S.I.
T.C.O.	18.0	1
Feed (T.C.U.)	14.3	5
Concentrate	10.5	7
Tailings	35.0	1

(e) FILTER CAKE : S.B.O. + CONCENTRATE = 10.2 ASH % 7 FSI

*All weights and analyses are on an Air Dried Basis unless otherwise indicated

Birtley Coal & Minerals Testing

SUMMARY - BULK WASHING DATA (Cont.)

MEDIUM - ASH PRODUCT

BULK SAMPLE D.SS. 23-CARDINAL RIVER COAL LAB NO. 4636

(F) CLEAN COAL: H.H.C.C. + FILTER CAKE Calculated Yield 69.5 %

	PROXIMATE								
ADM	RH%	ASH%	VM %	FC %	S	BTU	FSI	P	
5.4	0.4	8.4	19.9	71.3			7		

CLEAN COAL INVENTORY

	SHIPPED		IN STOCK	
DATE	BBLS	M.T.	BBLS	M.T.
March 19,1980			13	2.569

BULK WASHING DATA
MEDIUM - ASH PRODUCT

BULK SAMPLE D.S.S. 23-CARDINAL RIVER COAL LAB NO. 4636

HEAVY MEDIUM CIRCUIT

CYCLONE: 14" DSM operating @ 51.7 KPa.

MAGNETITE MEDIUM maintained @ 1.28 S.G.

1.	FEED(3/4 x 28 Mesh)	2.720	M.T.	14.7	ASH%	4	FSI
2.	CLEAN COAL	1.822	M.T.	7.6	ASH%	7	FSI
3.	REJECT	0.898	M.T.	29.6	ASH%	1	FSI

4. YIELD CLEAN COAL (Weighted) = $\frac{1,822}{2,720}$ = 67.0 %

5. YIELD CLEAN COAL (Calculated) = $\frac{29.6 - 14.7}{29.6 - 7.6}$ = 67.7 %

Birtley Coal
& Minerals Testing

BULK WASHING DATA
MEDIUM - ASH PRODUCT

Bulk Sample D.S.S.23-CARDINAL RIVER COAL LAB NO. 4636

WATER - ONLY CYCLONE CIRCUIT

Primary Cyclone: 6" DSM operating @ 137.9 KPa

Vortex Finder Clearance set @ 6.35 c.m.

Secondary Cyclone: 4" DSM operating@ 34.5 KPa

Vortex Finder Clearance set @ 5.08 c.m.

Sieve Bend : 65 Mesh

1. Feed (28 Mesh x 0)	14.1	ASH %	4 1/2	FSI
2. Primary Cyclone Overflow	11.5	ASH %	5 1/2	FSI
3. Secondary Cyclone Underflow	42.3	ASH %	1/2	FSI
4. Sieve Bend Overflow(S.B.O.)	9.6	ASH %	7	FSI
5. Sieve Bend Underflow(S.B.U.)	14.6	ASH %	3	FSI

6. Yield (W.O. Cyclone) $\frac{42.3 - 14.1}{42.3 - 11.5}$ = 91.6 %

7. WT% 28Mx65M in Primary Cyclone Overflow = 52.1 %

8. Estimated Yield of 28M x65M (S.B.O. , as % of 28 M x 0 Feed) = 47.7 %

Birtley Coal & Minerals Testing

BULK WASHING DATA
MEDIUM - ASH PRODUCT

BULK SAMPLED.S.S.23-CARDINAL RIVER COAL LAB NO. 4636

FROTH FLOTATION CIRCUIT

Flotation Cell: two(2) Birtley -Humboldt Multi-Wobble impellers in series.

Reagent : 4:1 = Kerosene:M.I.B.C.

Thickening Cyclone : 20° - 8" cyclone Hayl-Patterson

1. Thickening Cyclone Overflow (T.C.O. -325M) 18.0 ASH% 1 FSI

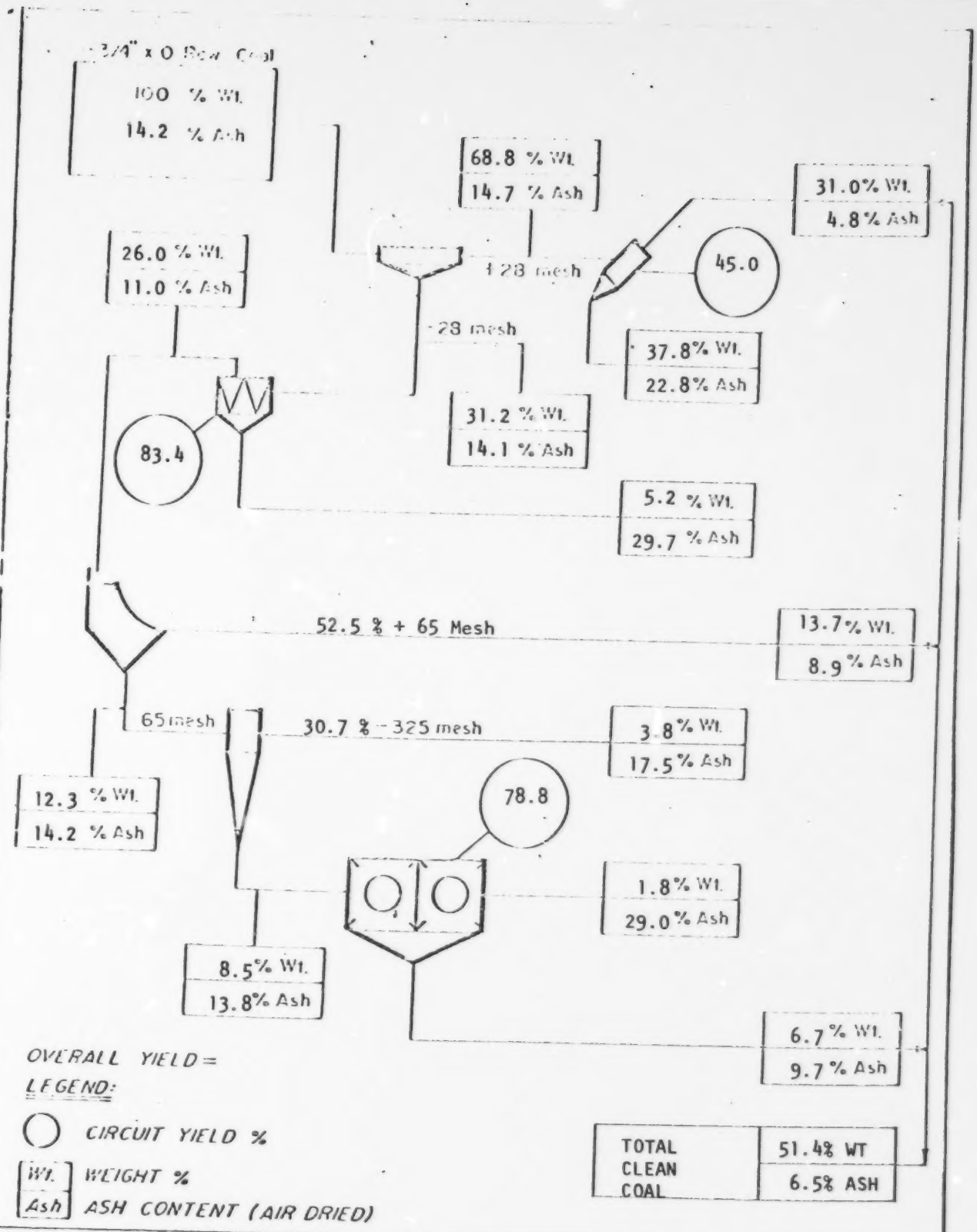
2. Flotation Feed(Thickening Cyclone Underflow) 14.3 ASH% 5 FSI

3. Concentrate 10.5 ASH% 7 FSI

4. Tailings 35.0 ASH% 1 FSI

5. Yield Concentrate $\frac{35.0 - 14.3}{35.0 - 10.5} = 84.5\ \%$

Birtley Coal
& Minerals Testing



BIRTLEY COAL & MINERALS TESTING

Title PLANT BALANCE FLOW SHEET
DEPARTMENT OF SUPPLY AND SERVICES
D.S.S. 23 BULK SAMPLE - CARDINAL RIVER COAL
LOW -ASH PRODUCT
LAB NO. 4637

Date
March , 1980

Drawn

SUMMARY - BULK WASHING DATA *

LOW-ASH PRODUCT

Bulk Sample D.S.S. 23 - Cardinal River Coal Lab. No. 4637

Date Received March 7, 1980 Date Washed March 12, 1980

(a) RAW COAL

Delivered Weight 10.808 MT Washed Weight 3.379 MT

ADM % 3.9 ASH% 14.2 F.S.I. 4

(b) HEAVY MEDIA CIRCUIT: 3/4" x 28 Mesh= 68.8 % by weight

S.G. of Medium 1.22 Calculated Yield 45.0%

Sample	ASH %	F.S.I.
Feed	14 7	4
Clean Coal	4.8	8 1/2
Reject	22.8	1

(c) WATER -ONLY CYCLONE CIRCUIT :28M x0 = 31.2 % by weight

V.F.C. #1 7.62 cm. #2 6.35 cm. Calculated Yield 83.4%

Sample	ASH %	F.S.I.
Feed	14.1	4 1/2
Overflow	11.0	6
Underflow	29.7	1
S.B.O,	8.9	7
S.B.U.	14.2	3 1/2

(d) FROTH FLOTATION CIRCUIT: 65M x0 12.3 %by Weight

4:1 =Kerosene: M.I.B.C. Calculated Yield 78.8%

Sample	ASH %	F.S.I.
T.C.O.	17,5	1/2
Feed (T.C.U.)	13,8	5
Concentrate	9,7	7
Tailings	29.0	1

(e) FILTER CAKE : S.B.O. + CONCENTRATE = 9.2 ASH % 7 FSI

*All weights and analyses are on an Air Dried Basis unless otherwise indicated

Birtley Coal & Minerals Testing

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SUMMARY - BULK WASHING DATA (Cont.)

LOW - ASH PRODUCT

BULK SAMPLE D.S.S. 23 - CARDINAL RIVER COAL LAB NO. 4637

(f) CLEAN COAL: H.M.C.C. + FILTER CAKE Calculated Yield 51.4%

	PROXIMATE								
ADM	RM%	ASH%	VM %	FC %	S	BTU	FSI	P	
6.5	0.5	6.6	20.1	72.8			8		

CLEAN COAL INVENTORY

	SHIPPED		IN STOCK	
DATE	BBLS	M.T.	BBLS	M.T.
March 18,1980			9	1.650

BULK WASHING DATA
LOW - ASH PRODUCT

BULK SAMPLE D.S.S. 23-CARDINAL RIVER COAL LAB NO. 4637

HEAVY MEDIUM CIRCUIT

CYCLONE: 14" DSM operating @ 51.7 KPa.

MAGNETITE MEDIUM maintained @ 1.22 S.G.

1.	FEED(3/4 x 28 Mesh)	2.325	M.T.	14.7	ASH%	4	FSI
2.	CLEAN COAL	1.030	M.T.	4.8	ASH%	8 1/2	FSI
3.	REJECT	1.295	M.T.	22.8	ASH%	1	FSI

4. YIELD CLEAN COAL (Weighted) = $\frac{1.030}{2.325}$ = 44.3 %

5. YIELD CLEAN COAL (Calculated)= $\frac{22.8 - 14.7}{22.8 - 4.8}$ = 45.0 %

Birtley Coal
& Minerals Testing

BULK WASHING DATA
LOW - ASH PRODUCT

Bulk Sample D.S.S. 23-CARDINAL RIVER COAL LAB NO. 4637

WATER - ONLY CYCLONE CIRCUIT

Primary Cyclone: 6" DSM operating @ 137.9 KPa

Vortex Finder Clearance set @ 7.62 c.m.

Secondary Cyclone: 4" DSM operating@ 34.5 KPa

Vortex Finder Clearance set @ 6.35 c.m.

Sieve Bend : 65 Mesh

1.	Feed (28 Mesh x 0)	14.1	ASH %	4 1/2	FSI
2.	Primary Cyclone Overflow	11.0	ASH %	6	FSI
3.	Secondary Cyclone Underflow	29.7	ASH %	1	FSI
4.	Sieve Bend Overflow(S.B.O.)	8.9	ASH %	7	FSI
5.	Sieve Bend Underflow(S.B.U.)	- 14.2	ASH %	3 1/2	FSI
6.	Yield (W.O. Cyclone)	$\frac{29.7 - 14.1}{29.7 - 11.0}$ =		83.4	%
7.	WT% 28Mx65M in Primary Cyclone Overflow	=		52.5	%
8.	Estimated Yield of 28M x65M (S.B.O. , as % of 28 M x 0 Feed)	=		43.8	%

Birtley Coal & Minerals Testing

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BULK WASHING DATA
LOW - ASH PRODUCT

BULK SAMPLED D.S.S. 23-CARDINAL RIVER COAL LAB NO. 4637

FROTH FLOTATION CIRCUIT

Flotation Cell: two(2) Birtley -Humboldt Multi-Wobble impellers in series.

Reagent : 4:1 = Kerosene:M.I.B.C.

Thickening Cyclone : 20° - 8" cyclone Hayl-Patterson

1. Thickening Cyclone Overflow (T.C.O. -325M) 17.5 ASH% 1/2 FSI

2. Flotation Feed(Thickening Cyclone Underflow) 13.8 ASH% 5 FSI

3. Concentrate 9.7 ASH% 7 FSI

4. Tailings 29.0 ASH% 1 FSI

5. Yield Concentrate $\frac{29.0 - 13.8}{29.0 - 9.7} = 78.8$ %

Birtley Coal
& Minerals Testing

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